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SATISFACTORY EXPORTS.

General trade and industrial conditions throughout the country are satisfactory and the latest crop reports all promise a continuance and extension of the prosperity that has been enjoyed recently. The Bureau of Statistics at Washington now supplements the data as to trade in general with some very cheering figures as to exports. This bids fair to be a notable year. May exports ran up to $123,735,529, as compared with $89,859,359 last May and about $101,000,000 in May, 1903. That is marked improvement. The imports were also $92,828,107, as compared with $80,694,749, showing a reciprocal expansion. The total exports for the nine months of the fiscal year are $1,397,350,140, or about ten millions more than in 1904, and nearly $75,000,000 better than 1903. The balance of exports over imports for the eleven months is almost exactly $370,000,000. There is no cause for grief in such an exhibit.

The gain in manufactured exports recently has been very striking. For May the amount was $48,269,705, or nearly ten millions better than last year, and over thirteen millions better than 1903. For the eleven months the total is $493,396,788, or nearly $80,000,000 better than 1904, and $120,000,000 better than 1903. It may be implied that a firmer grip on export trade and improved international trade relationships have been secured. Turning more particularly to electricity, conditions are encouraging. The exports of electrical machinery for the ten months ending April were $5,854,974, a gain of one million over 1903, and of at least $1,250,000 over 1904. The figures for April itself were $564,883, or nearly $35,000 better than in 1904. The exports of electrical instruments, additional to the above, also continue large. While a little less than in 1904, the total is nearly $500,000 better for the ten months than in 1903, being $3,060,126; while for April it was $443,478, as compared with $311,440 in April a year ago. Such figures must surely strengthen the resolve of American manufacturers to cultivate foreign trade steadily and push for new custom.

THE VALUE OF THEORY.

That the electron hypothesis is weakening faith in some of our most cherished theories of electrical action cannot be denied; and the time-honored tenets of magnetism are now subject to challenge as a consequence of the researches in non-ferric alloys by Fleming and Hadfield, an account of whose latest work appears in this issue. In view of this condition, which may be disturbing to the minds of those who do not properly recognize the real function of theory, it is well to remember that established theory should never be held as an article of faith—as is too often done when connected with names of high authority—but considered only as an acceptable generalization on all the facts in existence coming within the range of the theory. To hold any theory as an ultimate explanation of any set of phenomena implies that every fact relating to the phenomena is known—that nature has nothing more to reveal. It is, moreover, a condition of the growth of human knowledge in any department of science that whereas the advance never ceases in the acquisition of facts, yet the interpretation placed upon series of facts may vary markedly from time to time. The wealth of acquired material does not shrink, but always advances, sometimes rapidly and at other times more slowly. Nevertheless, the theories embracing the facts, and attempting to explain them, often wax and wither in a single decade. It might really be questioned whether in view of the history of mortality in theories it were worth while attempting to find a theory to fit observation, and whether it would not

be better to go on accumulating new materials of fact, heedless of their theoretical relations. The value of theory is, however, that it co-ordinates, or at least seeks to co-ordinate, the facts so as to permit of their proper grouping and presentation in natural sequence. Without the aid of theory, knowledge would constantly become more difficult, by accumulation; whereas, with the aid of theory, knowledge may actually grow easier to acquire, from age to age, in spite of the constant accumulation of material.

APPARATUS FOR TESTING INSULATION.

It is only a few years since 2,000 volts pressure for testing in the factory was regarded as very high. Now testing pressures of 150 kilovolts are commonly used and 250-kilovolt pressures are occasionally used. The adjustment, measurement and application of such pressures call for special apparatus and design. In practically all cases, as pointed out by Mr. C. E. Skinner in his recent N. E. L. A. paper, high pressures for testing are applied through the medium of step-up transformers. Occasionally cables are tested by direct-current dynamos of, say, 1 kilovolt pressure; but machinery in the factory is more conveniently tested by the use of portable alternating-current testing sets. The measurement of the high pressure offers considerable difficulty. There is objection to placing the measuring instruments on the high-pressure side, because not only is the resistance required in their circuit large and expensive, but there is also considerably increased personal danger incident to the use of high-tension measuring instruments. On the other hand, although the placing of instruments on the low-tension side is very convenient and simple, yet there is always a certain range of error involved by the charging current at high-pressure terminals affecting the ratio of transformation irregularly, and thus interfering with the precision of the measurements. A simple and reliable voltmeter for very high tension is much to be desired.

A NEW METHOD OF POTENTIAL REGULATION.

A striking point of difference between filaments is with respect to the change in resistance with variation in temperature. As is well known, the resistance of carbon continually decreases with increase of temperature, so that the current taken by the carbon filament varies at a rate considerably greater than the change in the impressed electromotive force, and the lamp is exceedingly sensitive to voltage variation. On the other hand, the tantalum filament possesses in a marked degree the property, common to metallic conductors, by which its resistance increases with increase of temperature, so that a change in the electromotive force across the terminals of a tantalum lamp results in a much smaller change in the current taken by the lamp. A practical advantage of this characteristic of the material is found in the fact that the illumination furnished by the tantalum lamp is much less dependent upon the value of the impressed electromotive force than in the case of the carbon lamp. In an article on page 20 of this issue Dr. A. E. Kennelly and Mr. S. E. Whiting show how the difference in the temperature resistance characteristics of the two lamps may be employed advantageously for regulating the electromotive force of a generator. The method suggested requires the use of two separate circuits connected to the terminals of the generator. In one of these circuits are placed tantalum lamps, while the other circuit contains carbon lamps. At normal voltage the currents taken by the individual circuits are equal in value Any increase in voltage causes the current in the carbon lamps to exceed that in the tantalum lamps, while a decrease in voltage produces the opposite effect. The authors describe two methods by which the relative change in the values of the two currents may cause a relay to operate the field rheostat so as to bring the electromotive force to its normal value. In one method —the Wheatstone bridge arrangement—the current in the coil of the relay is of zero value at normal voltage, and it assumes a value in one or the other direction according to the excess or deficiency of the electromotive force. In the second method—the differential relay system—it is merely the difference in magnetomotive forces of the two currents acting simultaneously upon the same circuit-changing device which tends to cause the electromotive force of the generator to remain at its normal value.

It is evident that the practical value of any method of potential regulation is determined by the relative freedom from complication, and by the sensitiveness of the controlling devices to change in electromotive force. A study of the article referred to will convince one that the apparatus is extremely simple, while the fact that under test the voltage was kept within one-half of one per cent of normal seems to indicate that the sensitiveness is satisfactory. The authors direct attention to the fact that the lamps are more sensitive to changes in voltage when operated at a low value of impressed e.m.f., and they give an equation for showing the relative sensitiveness for assumed conditions. Since, with the differential relay system the operation depends entirely upon the difference in currents in the two coils of the relay, it would seem that an arrangement by which the current in the one coil is kept at a constant value while that in the other fluctuates greatly with a change in electromotive force, would give the maximum possible sensitiveness. Such an arrangement is to be found in the use of a separate source of constant e.m.f. for the one coil (a storage battery) and the use with the other coil of carbon lamps in series across the mains of the generator. It is evident that this latter arrangement would eliminate the undesirable effects due to the thermal time lag, mentioned by the authors.

HIGH-VOLTAGE INCANDESCENTS.

We have read with much appreciation Mr. Howell's paper dealing with the claims made for the 220-volt foreign lamps. A thorough round-up of the situation was much needed, for the high-voltage lamps present so many disadvantages in the matter of distribution that a knowledge of their actual qualities has really become essential. The result confirms what previous experience has indicated, that it is a very difficult matter to make a lamp which at 220 volts or thereabouts shall be reasonably efficient and durable. We think that in incandescent lamp manufacture our American makers are rather ahead of the game. In fact, it would be rather discreditable to them were they not, since the lamp was American in its origin and is used more freely here than anywhere else in the world. From Mr. Howell's tests it appears not only that the foreign lamps for which so much has been claimed are decidedly inferior to the best American lamps, but they are far from bearing out the earlier reports of efficiency. In particular, American lamps seem to be much more closely and carefully rated so that their performance is more uniform and reliable. There is no doubt that a good 220-volt lamp would have a wide field of usefulness, but the tendency of improvements nowadays is strongly in the direction of increased efficiency, and the consumer is so potent a factor in the situation that increased efficiency must come. Improvements are already announced in carbon filaments that may have a very great effect on future practice. It is evident, however, from Mr. Howell's tests that the really economical high-voltage lamp will be likely to come rather through improvements here than through the example of existing foreign practice. Present lamps, of course, are not to be despised for special uses and in particular situations, but there is small prospect that high-voltage incandescents will even be as easy to make of high efficiency as those for more moderate pressure.

FRENZIED THERMODYNAMICS.

We observe with joy that our Subway friends have been stirred to strenuous measures. Whether the gloomy computations recently published have struck them with panic or whether some of them were caught, unhappy, in their own trap when the deadly water main got in its fine work the other day, we know not, but anyhow something is doing. The figures alleged are fearful and wonderful to contemplate. They would have struck with awe even the philosophers of Laputa, but no citation of authorities can give them much quantitative value since no one has yet investigated the case of conduction through the walls of a very long and narrow channel in which the air is given altogether abnormal convective action by continual stirring, nor has anyone yet evaluated the probable effect of a rigid embargo laid on Limburger, garlic and stogies. These add their terrors to the situation and defy both the computer and the bacteriologist. No analysis can ever do justice to the properties of Subway air—it has the peculiar lifeless qualities generally only to be found in a country town hall the day after town meeting. But it is not of record that a town hall ever was ventilated, while to the credit of the powers that rule the Subway be it said that they are just as anxious as the public for a good supply of fresh air. And fresh air they propose to have if there is any way of securing it. The fact is that, all computations to the contrary notwithstanding, a very long and relatively narrow subterranean gallery will not ventilate itself through infrequent and tortuous passages of small area leading to the exterior air. Nor will the trains, unless they fit so closely as to act as pistons, help to any adequate extent.

They keep the air stirred up, but fail to displace it in bulk. Here is the root of the difficulty. The obvious remedial measure is to provide forced draft, as has been done elsewhere under similar conditions. Bad air will not leave unless it is ejected with violence. All joking aside, it is certain that it would have been wise to put in forced ventilation at the start, and the sooner it is now done the better. The air in tunnels is never of the best. A tunnel used by some hundreds of thousands of people daily is certain to have an atmosphere which, if not seriously vitiated, is at least unpleasant and unwholesome, let alone the matter of temperature. We shall be interested to note the result of the reported refrigeration experiments if they are carried to a conclusion, but if the air is frequently renewed the temperature will take care of itself. The method of ventilation must, however, be carefully studied. The fans for the work must be big enough to move the required volume of air, forceful enough to overcome backwind, and so located that they will remove foul air and not merely create an eddy and pull out most of the fresh air that comes in. It has often happened that a fan of the dimensions and speed required to move a certain computed amount of air, fails dismally of its purpose because of inability to deal with back pressure due to wind, and from setting up eddies. The exhaust fans in such a case as that here discussed should pull from a clear column of air well removed from other ventilating apertures, and should give a normal air velocity high enough to perform the required duty against any probable wind pressure. If installed near or at stations they are likely to fail in clearing the tunnel in general. And from the shape of the area to be ventilated it is obvious that a considerable number of medium-sized fans are better than a few big ones. But this much is sure, that the work can be thoroughly well done, and will be done. The quality of the work can best be judged by its general effect on the passengers. Mere analysis and bacteriological tests only tell part of the story. They can detect the existence of exceptionally bad conditions, but air may be unpleasant and unhealthful without a very large amount of carbonic acid and without a large increase in the number of maleficient bacteria.

THE POWER FACTOR OF ALTERNATING-CURRENT ARCS.

It is well known that an alternating-current arc lamp has a power factor of marked importance. It varies between 30 per cent and 90 per cent as extreme values and is commonly about 70 per cent, so that the watts consumed by the lamp are commonly about 70 per cent of the volt-amperes delivered at its terminals. When this phenomenon was first observed, it was supposed to be entirely due to the effect of the series coils or reactances in the lamp. A large part of the difference between watts and volt-amperes was indeed traced to these reactances, but it was found that the arc itself had an effective reactance, and that the watts consumed in the arc itself might be in extreme cases as low as 80 per cent of the volt-amperes measured at the carbons. It was then imagined that this might be due to a c.e.m.f. in the arc. Investigation failed, however, to reveal any such c.e.m.f. The oscillograph showed, in fact, that the volts and the amperes crossed the zero line simultaneously, or substantially so, whereas had there been a c.e.m.f. in the arc as in a reactance, the current would have lagged behind the voltage; that is to say, the amperes would have crossed the zero line, in each reversal, after the volts. Finally, the effect was traced to a cyclic variation in the resistance of the arc. When the current through the arc is strong, the resistance of the arc is relatively low, and when the current through the arc is weak the resistance is relatively high. Consequently, the shape of the current wave through the arc is not the same as the shape of the voltage wave at carbons. The current wave is more peaked at the crest than the voltage wave. The fact that the power factor of the arc is not unity is due, or at least principally due, to this relative wave distortion.

A paper on this subject was presented by Prof. Shepardson at the convention of the American Institute of Electrical Engineers last week. This paper shows that the power factor does not vary much with the wave shape of impressed e.m.f. whether that e.m.f. be considered at carbons or at lamp terminals. In other words, whether the impressed e.m.f. be sinusoidal, peaked or flat, the power factor of the arc, and also the power factor of the lamp, will be practically the same. Moreover, the power factor of the arc was found to be distinctly higher with the enclosed arc than with the open arc. This is perhaps due to the difference in physical and chemical properties of the gases between the carbons in the two cases. The power factor was also found to be distinctly higher with cored carbons than with hard carbons. This seems attributable to the lower volatizing temperature of the core than of the carbon, whereby the arc is much more readily started again, with much less ohmic resistance, after each reversal, when cored carbons are used. The oscillographs accompanying the paper show many details of significance. It is shown, for example, that with enclosed arcs and cored carbons, the wave of current was a smooth curve roughly sinusoidal; whereas the wave of voltage at the carbons was nearly rectangular and flat-topped. In the case of the open arc with hard carbons the voltage was rendered even more distorted. The resistance in the arc at the times of feeble current was so great as to force the voltage into sharp peaks, so that the voltage at full current was only about half that at weak current. The voltage peak just after reversal is much higher than that just before reversal, indicating that the reversal of the discharge in the arc gives rise to a larger resistance accompanying a given current strength than when the discharge is merely subsiding. A wide field for research is opened in these directions. The real difficulty is that the field is too wide, owing to the large number of independent variables. The matter would be much easier to elucidate if a number of these variables could be either eliminated or kept uniform.

The Institute at Asheville.

A very full telegraphic account was given last week of the various exercises and functions connected with the annual meeting of the American Institute of Electrical Engineers held at Asheville, N. C. Our report closed on Thursday morning, at which time the Institute was holding its last regular session, including the papers of Messrs. Stanley and Howell.

On Thursday evening an enjoyable entertainment was participated in by the large number of the members and guests who still remained in attendance in the shape of an informal smoker at the Albemarle Club. A very pleasant late afternoon and evening was spent at bowling, billiards, etc., followed by refreshments and music. Many of the ladies and gentlemen resident in Asheville were present also by invitation, and their participation added greatly to the enjoyment of the affair. A feature of the evening was the presentation, accompanied by an appropriate speech by Mr. Charles E. Waddell, chairman of the local committee, of a silver loving cup to President Lieb, of the Institute, as a mark of appreciation from the local reception committee on behalf of the Southern members, with particular reference to the efforts to forward and to hold the meeting in the Southern country and to make the gathering a success. Mr. Lieb, in replying, paid a tribute to development in the South and to the work of the committee, and voiced the thanks of the Institute membership for the hospitality which had been shown every one in the entertainment extended. A silver matchbox was also presented by the local committee to Secretary Pope, of the Institute, as a testimonial of their esteem and as a souvenir of the Institute's first meeting in the South.

On Friday a number of the members took part in a special excursion to Toxoway, in the heart of the mineral and mining country of North Carolina. This excursion was greatly enjoyed by a large number. After this the exercises closed and the convention dispersed, with pleasant memories of a notable and highly enjoyable week.

Convention of the National Interstate Telephone Association.

In last week's issue was published a telegraphic report of the proceedings of the several sessions of the convention of the National Interstate Telephone Association held in Chicago at the Auditorium Hotel, June 20 and 21. The following is a more complete report of the proceedings. As announced last week, the work of the convention on Tuesday, the first day, was suddenly interrupted by the death of S. P. Sheerin, of Indianapolis, while reading an address at the opening of the convention. Immediately upon the occurrence of the sad event the convention adjourned for a few moments, and upon convening again adjourned until 3 p.m. Tuesday, when some necessary routine business was transacted.

At this time a committee of ten was appointed to draft resolutions on the death of S. P. Sheerin. This committee consisted of Jesse W. Weik, of Indiana; J. G. Splane, Pennsylvania; J. B. Ware, Michigan; George W. Beers, Indiana; E. B. Fisher, Michigan; E. L. Barber, Ohio; E. E. Clement, District of Columbia; James B. Hoge, Ohio; Theodore Gary, Missouri, and J. D. Powers, Kentucky.

As the constitution provides for a committee on amendments to the constitution, Colonel Powers, the temporary chairman, at the request of the Executive Committee, appointed a committee on amendments as follows: Theodore Throward, of Indiana; H. A. Price, Michigan; E. W. Dunnaway, Texas; W. G. Thompson, Ohio, and P. T. Spencer, California. A committee on credentials was appointed, consisting of J. G. Splane, of Pennsylvania; Richard Valentine, of Wisconsin; J. S. Bellamy, of Iowa, and G. M. Saltzgaber, of Ohio.

A committee on nominations consisting of one from each state was made up as follows: Stanley S. Lichty, Iowa; W. Roy McCanne, Missouri; W. Gilbert Thompson, Ohio; E. B. Fisher, Michigan; J. C. Harper, Wisconsin; Charles E. Wells, Kansas; P. Kerr Higgins, California; A. C. Davis, West Virginia; H. K. Cole, Kentucky; S. B. Rawson, New York; W. L. Moellering, Indiana; E. W. Dunnaway, Texas; E. E. Conklin, Illinois; W. H. Bryant, Alabama, and E. E. Clement, District of Columbia.

A committee of five was appointed to confer with a committee of the manufacturers for the good of the association. This committee was made up of E. L. Barber, Ohio; J. C. Splane, Pennsylvania; Richard Valentine, Wisconsin; C. Y. McVey, Ohio, O. N. Snyder, Ohio. The convention then adjourned until Wednesday morning at 9 o'clock, out of respect for Mr. Sheerin. The first business Wednesday morning was the reading of the resolutions drawn up by the committee of ten regarding Mr. Sheerin's death. These resolutions were adopted by the association and transmitted to the relatives of the deceased.

The committee on nominations reported in favor of the following officers, who were duly elected: President, James B. Hoge, Cleveland, Ohio; vice-president, Theodore Gary, Macon, Mo.; second

JAMES B. HOGE, PRESIDENT.

vice-president, John Van Liew, Los Angeles, Cal.; secretary, A. L. Tetu, Nashville, Tenn.; treasurer, J. G. Splane, Pittsburg, Pa. Immediately after the election the permanent officers took charge of the association.

It was then suggested that, inasmuch as Judge James M. Thomas, one of the founders, and the president of the National Association for several years, and the one who had led its patent litigation, had died since last convention, some action should be taken by the as-

THEODORE GARY, FIRST VICE-PRESIDENT.

sociation looking toward a recognition of his services to the independent telephone interests of the country. A committee to draw up such resolutions was appointed consisting of Dwight E. Sapp, of Ohio; E. B. Fisher, Michigan; F. L. Bean, Ohio; George W. Beers, Indiana; B. E. Hubbell.

The committee on the standard forms of accounting read a part of its report, leaving the balance to be published. Other papers read in abstract or in total were: "The Value of Telephone Securities," by A. B. Greenshields of Philadelphia; "Standard Toll Signs," by W. F. Laubach, Akron, Ohio; "The National Interstate Telephone Association," by James B. Hoge, Cleveland, Ohio; "Combined Telephony and Telegraphy," by Samuel G. McMeen, consulting engineer, Chicago.

The question of the standard sign to be used by independent telephone companies at local and long distance pay stations the country over was the one most fully discussed, as it was considered important that this convention adopt some such standard sign which would be as national in its character as the familiar Bell sign of the opposition. A sign was adopted at the close, as mentioned later.

Wednesday afternoon a roll call of states was carried out, in which a delegate from each state represented made report on the condition of independent telephony in his State. The two most notable features of this roll call as regards the number of telephone instruments in use were the figures from the city of Los Angeles, Cal., and the state of Iowa. The former reported 20,000 instruments serving a population of about 200,000. Rural development at its highest was shown by the claim of Iowa to 220,000 telephones, the independent movement being probably stronger in Iowa than in any other state in the Union. This is partly due to the fact that rural lines were early developed in Iowa, and such lines have acted as the most valuable feeders of the various independent exchanges. In fact, such lines may be said to control the situation, being necessary to the existence of the smaller exchanges. The Iowa telephone men have an association dating back to 1896. Delegates from other States reported experiences similar to those in Iowa, namely: That the rural lines control the situation as far as all the smaller exchanges are concerned. Many interesting experiences were related as to the struggle between the Independent and Bell interests in different states and the tactics adopted to get control of the situation.

A number of invitations were received from cities desiring the next convention. The first invitation was from Nashville, Tenn., the home of Secretary Tetu. Atlantic City, N. J.; Detroit, Mich., and Put-In-Bay, Ohio, also sent invitations.

It was decided to have a permanent committee of three on operating rules, and also a permanent committee on relations with manufacturers.

The permanent toll sign finally selected by the convention is the one which has been on the letterheads and literature sent out by the committees of the National Interstate Telephone Association; it is in the form of a banner in three colors—red, white and blue. The principal objections urged against this sign were its illegibility and the fact that it requires three colors as against the two colors used by the other signs proposed, the latter being an objection in ordinary advertising. The other signs proposed were the one used by the Michigan association, which is a blue banner with lettering above and below, and the one used by the Iowa association, which is a maltese cross with letters on the cross. The advertising value of the three-color sign was, however, considered by the association to outweigh the practical difficulties of its everyday use, and was adopted. The banner contains the words "Independent Local and Long-Distance Telephone" on its face.

The third day of the convention was given up to the inspection of the extensive exhibits of the manufacturers and to committee meetings. The president appointed the following executive committee, with the approval of the other officers, in according with the constitution: W. D. Barnard, Pennsylvania; Edward L. Barber, Ohio; Col. J. D. Powers, Kentucky; Theodore Gary, Missouri; John Van Liew, California; George W. Beers, Indiana; Richard Valentine, Wisconsin; Charles C. Deering, Iowa.

A committee on litigation and legislation provided for by the constitution was selected as follows: Dwight E. Sapp, Ohio, chairman; Breckenridge Jones, Missouri; E. E. Clement, District of Columbia; J. B. Ware, Michigan, and one member from Illinois to be appointed later.

An auditing committee was appointed, consisting of George W. Beers, of Indiana, and J. G. Splane, of Pennsylvania.

Later in the day the executive committee met and made plans for an aggressive campaign in the various states according to the ideas suggested during the convention. Permanent headquarters for the association for the year will be established in Cleveland, the president's city, where offices will be opened and the work carried on under the direct supervision of President Hoge. John A. Harney, of the Cuyahoga Telephone Company of Cleveland, was made assistant secretary, under salary, to take charge of the association's permanent offices, and give his entire time to the association's work. It was decided that a Department of Publicity should be started to further the interests of independent telephony the country over by keeping the public informed as to the extent of the independent telephone movement and exposing false reports circulated about it from time to time. The organization of this department was left to the president. It has been suggested that W. B. Woodbury, assistant general manager of the Cuyahoga Telephone Company, Cleveland, who acted as chairman of the Press Committee at the convention, and who is an ex-newspaper man, may be induced to take charge of this new department. The satisfactory way in which he handled publicity matters in connection with the Chicago convention demonstrated his fitness to handle such a bureau.

A large party of telephone men went to Indianapolis to attend the funeral of S. P. Sheerin, which took place on the day following the convention.

New York State Independent Telephone Association.

The annual meeting of the New York State Independent Telephone Association was held in Albany, June 16, 1905, at which seventy-eight delegates were present, represnting indpendent telephone companies throughout the state having an investment of more than $15,000,000. At the opening session on Friday morning an address of welcome was delivered by Corporation Counsel Honorable Arthur L. Andrews, representing the mayor, and responded to by Mr. T. Harvey Ferris, of Utica. The remainder of the morning session was spent in inspecting the exhibits of manufacturers and the exchange of the Albany Home Telephone Company.

At the afternoon session the following papers were read: "Toll Line Development," by Mr. T. M. Brush; "Consolidation," by Mr. George R. Fuller, Rochester; "Development in the East," by Mr. W. L. Burke, Troy; "Development in Southern New York," by Mr. George B. Wright, Binghamton; "New Methods of Construction," by Mr. M. R. Eaton, Niagara Falls. In the evening there was a river trip, and at 7 P. M. a clambake was served at "The Abbey."

The tariff report, covering a uniform method of handling and accounting toll business throughout the state, submitted some time ago by a committee consisting of Messrs. S. B. Rawson, T. S. Lane and Edward Davis, was unanimously adopted. The report recommended that the mileage should be based on the air line distance between the centers of the respective blocks in which stations are located. It was recommended that a tariff rate be based upon a minimum charge of .6 cent per air line mile for each conversation not exceeding three minutes' duration, with a minimum rate of 10 cents. A table accompanying the report, giving a scale of rates from 10 to 200 miles based upon the above unit rate, and other tables give the tariff for each additional minute and for a night rate.

It is provided that all stations originating toll messages shall be paid a commission whether the business is sent paid or collect. After deducting this commission, the remainder of the tariff is to be divided between the connectng companies in proportion to the ratio existing between the air line distances from the point of origin to the point of transfer, and the air line distance from the point of transfer to the point of destination, each toll line company assuming the mileage of and settlement with its own connection. Details are given concerning reporting toll business, method of handling tolls, handling of frank business, toll accounting, forms of accounting, tickets, daily toll ledgers, monthly report blanks, methods of determining balances due in general settlement, and toll stationery. Instructions are given for adjusting the division of revenue between a toll line and a group of companies operating in a limited district, each connected with the other, and one of which connects with the toll line.

A resolution was adopted reciting that the various departments and offices of the state of New York, located at various places in the state, are all equipped with the Bell telephone service, and expressing the opinion of the meeting that such departments and offices should not confine their patronage to any one system to the damage and exclusion of citizens who take service from other systems, and asking that departments and offices not already conducted up with independent systems be requested to install independent telephones.

The association is in a flourishing condition, having a membership of more than 200, which is rapidly increasing. The following officers were elected for the ensuing year: President, W. Howard Hendrickson, Albany; first vice-president, Mr. Boyd McDowell, Elmira, N. Y.; second vice-president, Mr. W. R. Campbell, Niagara Falls; treasurer, Mr. T. Harvey Ferris, Utica; secretary, Mr. T. S. Lane, Buffalo, N. Y.

Sixth Annual Meeting of the National Electrical Trades Association.

The sixth annual meeting of the National Electrical Trades Association was held at La Corona Hotel, Montreal, Canada, June 23, representatives being present from all the affiliated local associations in the United States and Canada. The delegates in attendance and the local societies represented were: Mr. G. M. Stuart, of the Stuart-Howland Company, Boston, Mass., representing the New England Electrical Trades Association; Mr. John H. Dale, president of the Dale Company, New York City, representing the Electrical Trades Society of New York; Mr. Charles M. Wilkins, of Partrick & Carter, Philadelphia, representing the Electrical Trades Association of Philadelphia; Mr. James Wolff, Chicago manager of the New York Insulated Wire Company, representing the Electrical Trades Association of Chicago; Mr. C. M. Wood, representing the Electrical Trades Association of the Pacific Coast; Mr. John Forman, Montreal, Canada, representing the Electrical Trades Association of Canada. There were also present General Secretary F. P. Vose, of Chicago, and Local Secretaries J. A. Mann, of Montreal, and F. Neilson, of New York.

At the business sessions, lasting the whole afternoon, questions of considerable importance came up and careful consideration was given them, particularly to the adoption of new operative resolutions and the modification of others. The retiring president and vice-president, Messrs. John Forman and James Wolff, were succeeded by Mr. Wolff as president and Mr. Dale as vice-president. General Secretary Vose was re-elected for the ensuing year. New York City was chosen as the place for next year's meeting.

In the evening the delegates were banqueted by the Canadian Association, Mr. John Forman acting as toastmaster. Besides those already mentioned the following-named gentlemen were at the board: R. E. T. Pringle, president of the R. E. T. Pringle Company, Ltd., Montreal; E. F. Sise, the Wire & Cable Company, Montreal; George Moffatt, the Robert Mitchell Company, Ltd., Montreal; George H. Olney, the E. T. Phillips Electrical Works, Ltd., Montreal; J. A. Burns, Munderloh & Co., Montreal; George H. Rough, the Packard Electrical Company, Ltd., St. Catherines, Ont.; George Leroux, the R. E. T. Pringle Company, Ltd., Montreal; A. Collyer, the Bullock Electrical Manufacturing Company, Montreal; Philip H. Hover, the New York Insulated Wire Company, New York; H. P. Kimball, the Standard Underground Cable Company, New York.

Speeches were made and toasts were offered by Messrs. Forman, Wolff, Wilkins, Dale, Wood, Vose, Mann and Neilson. Others entertained by story, song and instrumental music. The National Electrical Trades Association is composed of over three hundred representative houses in the electrical and allied trades in the United States, Canada and Mexico. It is a sort of credit information bureau, designed to keep the members informed of the credit of customers in those trades, and it effects its aims in a surprisingly simple and certain manner. Incidentally, the members are enabled to secure the collection of accounts which frequently are uncollectible without the assistance of attorneys. The association cannot begin to estimate in dollars and cents the benefit accruing from the credit information disseminated to the members, but it can and does estimate the value obtained through the incidental work of collections. For example, it is computed that the New York Society alone during its ninth year collected for its members approximately $256,000, an average of over $3,000 for each member. For this service there is no additional charge, the entire cost to the member being covered by the annual dues.

Power Transmission in South Africa.

It is reported that the principal mining interests at Johannesburg are now actively engaged in studying, in connection with the officers of the Mashonaland Railroad Co., the possibilities as to cost of installation and transmission of power from Victoria Falls, on the Zambesi River, to Johannesburg, a distance of about 1,100 kilometers, at a tension of 70,000 volts. In view of the cost of coal at Johannesburg, it is said by those who have been studying the problem latterly that the commercial transmission of this power is quite feasible. The available power of Victoria Falls is more than five times that of Niagara. The most serious problem is not in the technical difficulties, but in the patrol of the long line. The present plan contemplates the transmission of 36,000 hp for the initial installation. The available fall to be utilized is 120 meters.

Mr. Stillwell on the Tesla Criticisms of the Subway.

Last week we cited from the New York *Sun* a letter by Mr. Tesla attacking the New York Subway again. We now give below in full Mr. L. B. Stillwell's reply:

In a letter printed in your issue of June 16 Mr. Nikola Tesla points out what he says he considers a source of danger in the Subway, and reiterates an opinion, which he had previously expressed in your columns, to the effect that a mistake was made in not adopting what he calls "my alternating system of distribution, popularly known as the 'two, three, multi or polyphase.'" It is possible that some of your readers who have read none of Mr. Tesla's prophetic essays which have appeared from time to time during the last ten or fifteen years in the daily press may attach weight to his opinion, and as the public is greatly interested in the Subway and its operation, statement of a few facts seems pertinent and proper.

It will be recalled, perhaps, by your readers that in your issue of November 1, 1904, a letter from Mr. Tesla was published, in which, *inter alia*, he expressed the opinion that polyphase induction motors should have been adopted instead of continuous-current motors. Incidentally, he remarked also that the distributing mains ought to be insulated artificially by refrigeration, that he had recently perfected inventions which, "abolishing all barriers to electrical development, will soon sweep the world with irresistible force," that he approved Mr. Belmont's private car, that he had not seen the tunnel and did not know its location, and was equally ignorant as regards the power house, that the system adopted was of his own invention, but that it represented "the state of the art more than ten years ago"; that a mistake had been made in not asking the electric companies to furnish the best instead of the cheapest equipment, and that the Interborough Rapid Transit Company had never asked him for any expert advice or suggestion.

In a letter which was printed in your issue of November 11, 1904, I stated that Mr. Belmont and his associate directors had imposed upon their engineering advisers no limit of cost; that if any mistake in the selection of electric equipment had been made, it was mine—not Mr. Belmont's—and suggested that, if Mr. Tesla would present before the American Institute of Electrical Engineers a paper containing specific and definite criticism of the equipment, I should be glad to meet him for the purpose of a full and frank discussion.

This suggestion, for reasons which were perhaps satisfactory to himself, Mr. Tesla declined to adopt, and in a long letter, which you printed in your issue of November 27, 1904, in declining to appear before the Institute, he referred to a number of alleged accidents in the Subway—the majority of which never happened—and again stated that the system adopted was one which he had "devised many years ago"; that its adoption in this instance "was altogether too absurd to dignify it with any serious comment"; that polyphase induction motors should have been used, and that he believed in advertising.

In his latest letter, that of June 16, he reiterates some of the statements contained in previous letters, and calls attention in the following words to a new danger which he has discovered: "The danger to which I refer lies in the possibility of generating an explosive mixture by electrolytic decomposition and thermic dissociation of water through the direct currents used in the operation of the cars." His alternating-current, polyphase system, as he says, would be free from this danger. Obviously, a charge so serious as this should rest upon a very substantial foundation of fact, and no consideration of self-interest or of personal animosity will excuse its author unless he can prove his charge. And what does Mr. Tesla offer as evidence that electrolytic decomposition of water is taking place in the Subway? He says: "It will be recalled that an expert found the percentage of free oxygen in the Subway appreciably above that which might reasonably have been expected in such a more or less stagnated channel." In other words, the Subway air contains more oxygen than Mr. Tesla expected, and upon this fact he constructs his theory of the production of oxygen and hydrogen gas by electrolysis. He does not offer in his letter a scintilla of evidence that oxygen is thus being set free. No one has alleged that the air in the Subway contains more oxygen than uncontaminated and free air. If Mr. Tesla, therefore, is comparing an actual analysis with anything more definite than his own notion of the kind of air that might be expected in the Subway, it is for him to make clear his reasoning.

Prof. Charles F. Chandler, who was recently employed by the Health Department of the City of New York to test the condition of the Subway from a sanitary standpoint, with especial reference to the purity of the air, says:

According to the best authorities, as, for example, Dr. John S. Billings, in his work, "Ventilation and Heating," the chemical composition of the atmosphere when uncontaminated is as follows:

Oxygen, 20.80 per cent; nitrogen, 70.20 per cent; carbon dioxide, 0.03 or 0.04 per cent.

The composition is not absolutely constant, the oxygen being sometimes a little higher and sometimes a little lower than the percentage given above.

Thus far fifty samples of Subway air have been carefully analyzed and the percentage of oxygen determined, the result being a maximum of 20.80 and a minimum of 20.30—average 20.55. At the same time, nine samples of surface air were examined, showing a maximum of 20.90 and a minimum of 20.60—average 20.76.

It will be noted that the percentage of oxygen in Subway air, as determined by Dr. Chandler, is a little less than that of normal uncontaminated air; there is, therefore, no excess of oxygen to be accounted for.

Among all that Mr. Tesla has said upon the subject, three charges besides that relating to alleged excess of oxygen perhaps call for reply in order that any part of the public which may have been disturbed by his statements may be reassured. These charges are: (1) That a mistake was made in not adopting polyphase induction motors; (2) that "not a single electrician of the General Electric or Westinghouse Companies was consulted," and (3) that "a mistake was made in not asking the electric companies to furnish the best instead of the cheapest equipment."

The last of these charges I answered in my letter of November 11, 1904. It is absolutely without the slightest foundation in fact. The management of the company aimed to secure the best system available, and no limitation in respect to cost was imposed upon its engineers. Apparently Mr. Tesla seeks to convey the impression that the polyphase induction motor system is more expensive than that adopted. As a matter of fact, the reverse is the case, the chief claim of the induction system residing in the fact that it is less expensive than the system which the Interborough Company has adopted. Several years ago, when tenders were submitted by manufacturers to the Metropolitan and District Underground Railways in London the induction motor system was proposed by Ganz & Co., of Budapest, and the price asked was approximately two-thirds the average price of the competing tenders, which were based upon the system which has since been adopted for the New York Subway.

The responsibility for decision in respect to the system adopted rests primarily upon me, but the plans were duly examined and approved by Messrs. Duncan and Hutchinson, consulting electrical engineers to the Rapid Transit Commission. As regards consultation with electricians and engineers of the General Electric and Westinghouse Companies, I have been in touch with the leading representatives of both companies from the outstart of this work up to the present time. Many of these gentlemen have contributed largely to the success of the installation and operation of the electrical equipment, and, so far as I am aware, are unanimous in believing that the best system available was adopted.

In support of his contention that a mistake was made in adopting the system which is in use, Mr. Tesla has offered simply an expression of his personal opinion. The polyphase motor system, as developed by Ganz & Co., of Budapest, undoubtedly has very strong points to commend it under certain conditions; and for what Mr. Tesla did in the early days of its inception the engineering world is under obligation, which in America has been fully recognized. Since certain United States patents were issued to him in 1888, however, he has done little, if anything, toward perfecting the motors, and still less toward the development of the multitude of other devices which in the aggregate constitute an electric traction system. Scott, Lamme, Steinmetz, Berg and others in Pittsburg and Schenectady have developed and improved the induction motor so that it is now extensively used in stationary work; but it has never been used in America for traction purposes upon any scale which would have justified its adoption by the Interborough Company. In Europe, within the last five or six years, the engineers of Ganz & Co. have developed it for traction purposes, and under certain conditions they have demonstrated its value in this field. Possibly this fact explains Mr. Tesla's recently revived interest in the motor of this type.

In conclusion, I may mention the fact that the system adopted for the operation of the Subway and elevated is identical with that adopted in Paris for the operation of the Metropolitan, in London for the operation of the so-called "Twopenny Tube," the Metropolitan and the District Railways; in Brooklyn for the operation of the elevated lines; that it has been adopted by the engineers of the Pennsylvania Railroad, the Long Island Railroad and the New York Central & Hudson River Railroad, and is largely used throughout America for the operation of interurban railways. The induction motor system, as supplied in Europe by Messrs. Ganz & Co., is beyond question an operative, and in many respects most excellent system. Hitherto, however, American manufacturers have not placed such a system upon the market. I think I am safe in saying that at the time when Mr. Tesla thinks the induction motor should have been adopted in the Subway not a single motor of this type was in use in America for traction purposes.

Municipal Trolleys in Glasgow and Private Ownership in Boston.

One of the most critical and exhaustive comparisons between municipal trolleys and private trolleys is that made as follows by Mr. Hayes Robbins in the *American Journal of Sociology:*

Suppose, for example, the comparison is made between the Glasgow experiment, which is decidedly the most favorable for municipal ownership that could be taken, and the Boston system, which, if it is indeed the best in the United States, has many a close second so far as practical operation is concerned, whatever may be said of the general fiscal relations with the community. Of that more later.

Glasgow today has 139 miles of tramway, measured as single track. The population of the city is about 800,000, and in the financial statement and general account issued by the Tramways Committee the total population served, including the suburbs, is given as 1,000,000. The Boston Elevated Railway Company operates, as a unit, some 440 miles of elevated, subway and surface lines, and serves approximately the same aggregate population, including the suburbs. In other words, Glasgow has one mile of track for every 7,200 of population, in round numbers; Boston, one mile for every 2,270. The Glasgow system in 1902-3 carried 177,179,594 passengers; the Boston company carried about 236,000,000 paying passengers, of whom 130,000,000 used free transfers, making 366,000,000 separate trips furnished. The average daily traffic is: Glasgow, 485,000; Boston, 1,000,000. The Glasgow rolling stock consists of about 680 cars of all kinds; the Boston company owns over 3,300. The average number of cars operated in one day in Glasgow is now about 450; in Boston, 1,300. Thus Boston operates one car for every 770 passengers carried each day; Glasgow, one car for every 1,077. This difference is reduced, however, by the fact that practically all the Glasgow cars are "double-deckers," seating from 50 to 55 passengers.

In summer the average seating capacity of the elevated and open surface cars on the Boston system is nearly, if not fully, equal to that of the Glasgow cars, and this with protection from the weather and without the delays and inconvenience in requiring passengers to climb to the roof. Double-deck cars were tried in Boston at one time, but abandoned because it was found impossible to handle heavy traffic with sufficient expedition; and it is chiefly on this account, in fact, that the street railway judgment of this country has been, on the whole, against the use of this type of rolling stock.

The Glasgow system, June 1, 1903, with 130 miles (measured as single track) represented a total capital investment of $13,405,024, or $103,115 per mile. The Boston system, including stock and bonds of leased lines, is capitalized at a little less than $44,500,000; and if to this be added the cost of the city-owned subway, on which cost the company pays interest and a liberal sinking-fund contribution, the total capital investment becomes, approximately, $48,500,000, or $110,227 per mile. There is no presumption of overcapitalization here, as compared with Glasgow, in view of the costly elevated and subway sections which form a part of the Boston service, and of the further fact that labor cost of construction in this country includes a wage rate practically double that of Scotland, and which is only partially offset by the superior skill and energy of our workmen.

The Boston system, with earnings of about $12,000,000 annually, pays a direct tax of seven-eighths of 1 per cent on gross earnings, a state corporation tax of about $16 per $1,000 of market value of the

stock, and local taxes on its real property in the various municipalities through which its lines pass, ranging from $15 to $20 per $1,000 of assessed valuation, and in addition is required to remove snow and ice from and maintain the paving on the street surface occupied by its tracks. The interest which it pays on the cost of the subway is sufficiently in excess of the interest the city has to pay on the bonds issued for its construction to retire the bonds and make the subway the city's property free and clear in less than forty years.

The total of these taxes and service obligations and excess interest payment now amounts to upward of $1,550,000 a year, or nearly 13 per cent of the gross earnings. Glasgow, with a street railway revenue of $3,178,471, in 1902-3, paid into the "Common Good" $121,650, to which should be added the taxes which the municipality as a whole assesses upon the tramway property, amounting in 1902-3 to $88,488. A further addition should be made of $83,982, being the average annual payment by the Tramway Committee since 1894 into the sinking fund for reduction of the capital debt; these payments, of course, are profit to the municipality in that they give it that much clear interest in the property as an asset. The total of these payments which go to the public good is $294,120, or slightly over 9 per cent of the gross revenue. The Boston corporation, serving the same population as the Glasgow lines touch, pays to public benefit account more than five times the gross amount so paid by the Glasgow system, and 39 per cent more in proportion to earnings

The question of fares cannot be considered apart from that of the amount of service furnished. What are the facts, then, as between Glasgow and Boston? Glasgow has a graduated scale of fares, ranging from 1 cent for a little over half a mile to 8 cents for 9 miles. The standard 5-cent fare in this country takes a passenger 5.8 miles in Glasgow. Needless to say, the confusion and complications of such a system, for the varying distances traveled, would prohibit it from meeting the demand for the utmost possible expedition on our large American city transit systems. Even more serious is the increasing rate of penalty it imposes upon the wide distribution of traffic, and hence upon the building up of workingmen's homes in the suburbs.

In Boston the uniform fare is 5 cents, and by means of the free-transfer privilege it is possible for this sum to ride from one end of the system to the other, fully 20 miles. Wage-earners and clerks employed in the business districts can live eight to nine miles out and ride to and from their homes for 5 cents, while the Glasgow "suburbanite," to travel equal distances, if the lines extended that far, would have to pay 7 and 8 cents, respectively. A journey of 15 or 16 miles out from central points in Boston, by connection with outlying suburban lines, may be taken for 10 cents, and 20 to 25 miles for 15 cents. The same distances under the Glasgow rates would cost 13, 14, 18 and 22 cents, respectively.

The short ride and congested district character of the Glasgow service must be borne in mind in connection with the fact that the average amount received per passenger, based on the returns of annual earnings, is a little less than 2 cents. In Boston, counting the free transfer passengers, it is about 3¼ cents. But what is the effect of the sliding scale on Glasgow traffic? Simply that the great bulk of the travel consists of short rides within the city limits. Thirty-six per cent of the passengers pay one-cent fares; that is, ride only half a mile; 56 per cent pay the two-cent fare, covering 2.33 miles; only 8 per cent pay fares of 3 cents and upward; in other words, only 8 per cent make journeys of more than 3.5 miles.

To be even more explicit: The most distant suburban point to which the Glasgow tramways extend is Paisley, 6.95 miles. To get there costs 6 cents, or 7 from the center of the city. The next farthest point is Clydebank, 6.39 miles; fare, 6 cents. Three other suburbs are between four and five miles, and one about three and a third. From Park Street Station, Boston, a passenger may ride 9.53 miles to Arlington Heights for 5 cents; 9.83 miles to Charles River Bridge; 8.23 miles to Arlington Center; 8 miles to Waverley; 7.9 miles to Melrose line; 7.36 miles to Milton; 7.3 miles to Neponset; 6.32 miles to Woodlawn, and 6.04 miles to Lake Street, and the uniform fare for any one of these journeys, or for any two of them in combination, through free transfer, is 5 cents.

The Glasgow system is not doing what it might and ought toward relieving the terrible congestion of workingmen's families huddled within the cramped distance limits. That the need of such distribution is great appears from the fact that more than 30 per cent of the families in Glasgow, according to an investigation made a few years ago, were living in single rooms, as compared with about 1½ per cent in Boston.

But there is yet another most important consideration entering into this matter of fares—the question of wages. The relation of wage-rates paid to the average fare charged is twofold.

First, wages are by far the largest item of operating expenses, and, as between two systems using substantially the same traction methods and carrying approximately the same number of passengers per car, the one paying the higher wages must necessarily charge a higher rate of fare. If the system paying the higher wages also operates more lines and furnishes a larger number of cars for the amount of traffic handled, all the more reason why the rates of fare must be higher.

Both Glasgow and Boston use the system of electric traction. Boston operates more than three times more track, and runs 40 per cent more cars in proportion to traffic. How about the wages? The pay of motormen and conductors in Glasgow ranges from 97 cents per day during the first six months to $1.22 after three years of service. In Boston surface-car conductors and motormen receive $2.25; elevated motormen, $2.30 the first year, $2.40 the second and $2.50 the third; brakemen, $1.85; guards, $2.10; while all these employes receive 3 cents per day additional after five years of service, 10 cents after ten years, and 15 cents after fifteen years. These rates are about double those paid in Glasgow.

From the operating standpoint, therefore, whether it be in respect to wage expense, trackage operated or amount of car movement, or all three, as is actually the case, there is abundant reason for higher average fares per passenger carried on the Boston system.

The second respect in which the wage matter relates to fares charged brings in the question of purchasing power. The differences between Boston and Glasgow street railway wages reflect similarly wide differences between the general "run" of American and Scotch wages all along the line—not so great in some cases, of course; in others greater. It is one of the truisms of economics that prices are to be considered high or low; not absolutely, but solely with reference to the purchasing power of the community, and in a community where wages are practically double the rates prevailing in another an average fare of 3¼ cents would be, if anything, somewhat cheaper than one slightly under 2 cents in the other; at least, so far as concerns the army of wage-earners and clerks, and their families, who constitute the great majority of the patrons of any urban transportation system and are the people to whom the matter of rates and service is of chief importance.

It may be urged, as accounting for some of the relative advantages of the Boston system, that it is surrounded on all sides by "feeder" electric roads which deliver passengers from an area including a considerably larger population than is brought into touch with the Glasgow lines. The fact is, however, that the bulk of the business from this wider area is handled by the suburban service of the steam railroads. Hundreds of trains each day, in and out of the two great terminals in Boston, accommodate an immense traffic, and not only from outlying points, but from stations directly within the territory of the Boston elevated, and in constant competition with it; so that the accounts are probably square in this respect. As a matter of fact, the proportion of traffic on the Boston Elevated Company's lines which does not originate within its own territory, compared with the total business, is small.

The reasonable deduction from these somewhat extensive comparisons seems to be that, while public ownership and operation of street railways, under the favorable civic conditions of British municipalities, in most cases give a better and cheaper service than was afforded by the various private corporations it supplanted, even this improved service is relatively meagre in extent and usually of mediocre quality, compared with American experience, and that the municipalized enterprises would break down entirely if subjected to any such tests as are commonly required under American conditions.

Glasgow was selected for comparison, as already observed, because it makes the best showing for municipalization, probably, to be found anywhere. In other British experiments results are less favorable, some of them markedly so; but in few of them have the facts ever been presented with sufficient clearness and fairness to warrant any very precise comparisons. The experiment of the London County Council in constructing electric lines in the south of London is a case in point. It appears that in 1899 the Council's experts estimated the expense of this undertaking at about $1,242,000. It has only recently been completed and proves to have cost some $4,800,000. In consequence of this excessive expenditure there seems to be a fair prospect, according to the chairman of the Finance Committee of the County Council, that the expenses and charges against these lines will exceed the income and the deficit will have to be added to the tax budget.

The Boston Electrical Show.

The executive committee of the Massachusetts Association of Electrical Contractors held an important meeting, June 22, at which reports were made showing that details of the fifth annual convention of the National Association of Electrical Contractors have been perfected. The exposition will open in Mechanics Building, Saturday evening, July 15, with a musical programme by Reeve's American Band, which will also give concerts throughout the week. A large and efficient reception committee will be at headquarters and will meet the specials due from New York and the west. The open session of the convention on Wednesday will be a notable event. Addresses of welcome will be delivered by F. L. Barnes, president of the Massachusetts State association; by Governor Douglas in behalf of the State, and Mayor Collins in behalf of the city. E. McCleary, of Detroit, Mich., president of the National Association, will then deliver the annual address, after which will come addresses and topics as follows: "The Electric Contractors' Association," by Charles L. Eidlitz, of New York, ex-president of the National Contractors' Association, and ex-president of the Building Trades Association of New York; "The Jobbers," by A. L. Gorman, of New York, general manager of the Manhattan Electrical Supply Company; "The Manufacturers," speaker to be announced; "The Underwriters," by F. E. Cabot, of Boston; "The Relations of Inspector and Contractor," by P. J. Kennedy, of Boston, commissioner of wires. There will also be other prepared addresses and general discussions.

An executive session of the National Association will be held Wednesday afternoon, and the annual dinner to the members of the National Association will be given in the evening. Thursday forenoon will be devoted to a session of the association and at 2.30 p.m. delegates and guests will embark at Rowe's Wharf for a steamer trip down the bay, dining at the Rockland House, Nantasket, and visiting Paragon Park in the evening. Friday will be devoted to executive sessions of the National Association and Saturday will be given up to sight seeing and entertainment.

A ladies' committee of thirty has been appointed to have charge of the entertainment of the lady guests of the association. Concord, Lexington, Bunker Hill, Harvard College and other historic and interesting places will be visited and an extended auto trip will be taken along the picturesque North Shore. Side trips for sight seeing and shopping will be made daily. Delegates have already been reported from 39 States.

Following is a partial list of those exhibitors who have secured space: American Electric Novelty Manufacturing Company, New York; American Circular Loom Company, Chelsea, Mass.; *American Electrician*; American Electric Contractor Company, American Electric Sign Company, Boston; Automatic Electric Train & Station Annunciator Company, Lexington, Mass.; Appleton Electric Co., Bridgeport, Conn.; Booth & Co., Boston; Bryant Electric Company, Bridgeport, Conn.; Benjamin Electric Company, New York; Bova, L. E., Boston; Couch & Seeley Co., Boston; Cotton, Chas. A., Boston; Chase-Shawmut Company, Boston; Condit, S. B., Jr., Electrical Company, Boston; Dale Company, New York; De Veau Telephone Company, New York; Dossert & Co., New York; Delaware Hard Fibre Company, Wilmington, Del.; Dorn, Philip, Boston; Electric Gas Light Company, Boston; Economical Electric Lamp Company, New York; Eastern Carbon Works, Jersey City, N. J.; Electro-Dynamic Company, Bayonne, N. J.; Edison Electric Illuminating Company, Boston; Eastern Electric Cable & Wire Company, Boston; ELECTRICAL WORLD AND ENGINEER, New York; *Electrical Review*, New York; Elm City Engineering Company, New Haven, Conn.; Erickson Electric Equipment Company, Boston; Forg, Peter, Somerville, Mass.; Felkin, A. C. & M. L., Boston; Gleason, John L., Jamaica Plain, Mass.; General Electric Company, Schenectady; Gould Storage Battery Company, Boston; Greenwood & Daggett Co., Boston; Homes Manufacturing Company, New York; Harvey Hubbell, Bridgeport, Conn.; Hill, W. S., Electric Company, New Bedford, Mass.; Johnson & Morton, Utica, N. Y.; Johns-Manville Co., H. W., New York; Knowles, C. S., Boston; Lowell *Daily Mail*; McKenney & Waterbury Co., Boston; Mullen, Colman J., Brooklyn, N. Y.; Manhattan Electrical Supply Company, New York; Minimax Company, Boston; Marshall Electric Manufacturing Company, Boston; Miller Anchor Company, Norwalk, O.; National Carbon Company, Cleveland, Ohio; Ovington Manufacturing Company, Boston; Pass & Seymour, New York; Pettingill-Andrews Co., Boston; Proctor-Raymond Manufacturing Company, Detroit, Mich.; Poole, J. W., Columbia Street, Boston; Renim Specialty Company, Boston; Ridgeway Dynamo & Engine Company, Boston; Roebling, John A. Sons Co., New York; Steel City Electric Company, Pittsburg, Pa.; Safety Armorite Company, New York; Sprague Electric Company, New York; Smith Premier Typewriter, Boston; Swazey & Smith, Boston; Stuart-Howland Company, Boston; Simplex Electric Company, Boston; Starbuck Sprague, Boston, Mass.; Street Railway Bulletin, Boston; Trumbull Electric Manufacturing Company, Plainville, Conn.; Valentine Electric Sign Company, Atlantic City, N. J.; Westinghouse Electric Manufacturing Company, Boston; White, O. C. Co., Worcester, Mass.; Wireless Railway Company, Philadelphia; Y. M. C. A., Boston.

Convention of New York State Street Railway Association.

The annual convention of the New York State Street Railway Association was held June 27 and 28 at Fort William Henry Hotel, Lake George. The meeting was a successful one and much interest was shown in the exhibits displayed, this feature assuming this year more than usual importance.

The "Question Box," edited by Mr. C. B. Fairchild, Jr., comprised 144 pages, and about 50 questions on practical subjects received answer. The greatest amount of space is occupied by subjects of a general managerial and operating character. Next came mechanical subjects, 34 pages; power house, 17 pages; line department, 17 pages; track department, 18 pages. Questions and answers in the department of advertising indicate the importance that this subject is assuming with street railways. A great diversity of opinion, however, was shown as to the methods of advertising. As in the case of the "Question Box" of the National Electric Light Association, there is, in fact, little concensus of opinion on any subject, the reason doubtless being that local conditions, both physical and with relation to policy, vary so much as to require most questions to be settled on the merits as they appear in a special case. There was, however, considerable unanimity of opinion that fares on suburban lines should be based on mileage; the suggestions as to the proper rate per mile ranged from one cent to two and one-half cents, but the majority were in favor of one and one-half cents. As to the amounts that should be laid aside for claims, the recommendations varied from one per cent to six per cent.

Mr. Henry W. Blake presented a paper entitled "Contrasts Between Company and Municipal Ownership and Management of Public Utilities," which gave an excellent discussion of the question. The difference of the conditions affecting municipal ownership as they exist in this country and Europe were pointed out and it was shown how American railways under private ownership give a vastly better service than British roads. Since in the municipalization of American street railways the present owners would have to be fully compensated, the question resolves itself entirely into one of public policy as to whether or not a better and cheaper service would be rendered under municipal ownership; whether the policy of constantly extending facilities could and would be continued; whether the financial burdens involved would be more equitably distributed than now, and, above all else, whether there would not be introduced into our American political system a corrupting influence and power for evil far greater than any encountered in past American history. The paper discusses in full these several questions, much statistical information being given. The conclusion is that this country should not embark in municipal railway ownership unless there be probable some great compensating advantages not yet apparent from European experience with municipal ownership and management of public utilities.

Dr. P. H. Peck presented a paper entitled "Uniform Standards of Examination of Railway Employes," in which he gave instructions in detail for testing vision, color, hearing and state of physical health.

Mr. J. Harvey White, in a paper entitled "Publicity," gave an account of the advertising methods pursued by the Boston Elevated Railway Company.

Mr. J. N. Shannahan, in a paper entitled "Types of Interurban Cars," described two of the types of cars in service on the Fonda, Johnstown & Gloversville Railway, pointing out their advantages and disadvantages for that service.

High Potential Surges.

Dr. Steinmetz, in discussing his own and Mr. Thomas' paper, at the Asheville meeting of the American Institute of Electrical Engineers, stated that there existed undoubted evidence that the arc is self-rupturing; that is, it mends itself in the extreme suddenness, and the potential at mending may be greater than the striking voltage. After the arc mends itself it immediately ruptures again, and it then becomes an oscillating arc. The frequency of oscillation is determined by the capacity and the inductance, and not by the frequency of the electromotive force. If a condenser and an induction coil be placed in series with each other, by means of a spark gap an oscillating current may be produced in the system even when the supply electromotive force is continuous. One of the conditions under which an arc becomes self rupturing is that the voltage exceeds the striking distance of the arc and that the flow of current in the arc causes the potential difference at the arc to drop practically to zero, and remain at zero a very short time after the arc has ruptured. Therefore, in experimenting with the arc in a circuit containing resistance in series and no capacity, the arc is not oscillating or self-rupturing, and cannot be made so, because simultaneous with the mending of the arc the voltage rises and so prevents the arc from rupturing. When high-frequency oscillations are produced by shunting the arc with capacity and inductance in series the length of time the arc exists is the time required by the charging current of the condenser to heat the air sufficiently to cause an explosion, and also to discharge the condenser and allow the voltage to drop to zero. The period of the zero current is the time required for the condenser to be recharged by the voltage from the inductance. The frequency of the oscillating arc can, therefore, be varied by varying the inductance, the capacity or the length of the spark gap, all three elements entering into the determination of the frequency. The phenomena become more complicated where, instead of localized inductance and capacity, there are distributed inductance and capacity as in cables. In favor of the explanation of the oscillating arc here given may be stated the fact as observed by Mr. Stott that short circuits were always preceded by grounds on the lines and by static displays. If the explanation is correct, and if the e.m.f. reaches 100,000 volts, and the current is as large as 9,000 amperes, there is no possibility of insulating and protecting against these surges. The only course to pursue is that taken by Mr. Stott in avoiding the cause of the surge and eliminating the continued occurrence of the spark discharge between the conductor and ground by disconnecting with the regular automatic circuit breaker, that particular cable in which the spark first appears before the damage can spread farther and produce high-power, low-frequency surges.

Restriction of Right to Telephone Service.

The Appellate Division of the New York Supreme Court for the Second Judicial Department in an opinion recently rendered confirmed the decision of a lower court supporting the New York Telephone Company in its refusal to render a telephone service in a case where there was a suspicion on the part of the police authorities that it was to be used for pool selling purposes. The applicant for the writ of mandamus refused was the proprietor of a cigar shop, in which several persons had been arrested by the police upon the charge that they were engaged in the business of selling pools on horse races. The applicant insisted that he was not chargeable with knowledge of these transactions, but the court held that it seemed improbable that he did not know what was going on. A point upon which the court laid much stress was that the applicant refused to write a letter to the telephone company, stating that he would not and did not intend to use the telephone for illegal purposes, and would not give the company a reference. It held that this did not seem to be an unreasonable requirement, particularly in view of the fact that the New York Telephone Company had been informed by the police department that the premises had been used as a pool room, and that it was also aware that a telephone which it had previously installed therein had been removed by the police. Consequently the officers of the company might not unreasonably apprehend that they would render themselves liable for aiding and abetting a violation of the law if they furnished further telephone service on the premises.

Resolutions on Death of S. P. Sheerin.

The resolutions adopted by the National Interstate Telephone Association on the death at the post of duty of Mr. S. P. Sheerin refer in high terms to his character and ability. In the entire field of telephony, they state, a more conspicuous champion of the independent movement, a more zealous laborer for our common cause and mutual good, could not have been found. "He knew no season. At all times and in all places he proved his devotion to the independent telephone interests; and so faithful and unremitting were his efforts that it may be truthfully said he died in the harness—in the very act of appealing to the greatest constituency on earth—the American people—for our just rights and a square deal.

"He was a man of fertile resources and deep usefulness. The son of a mechanic and himself a laborer over the anvil, in his father's shop, he early demonstrated his skill and ability. His associates and neighbors, impressed by his faithfulness and worth, chose him to fill one of the important offices, that of recorder in Cass County, Ind. From that he was promoted to the more noteworthy position of clerk of the Supreme Court of Indiana. But meanwhile his reputation had grown beyond the confines of his State, and in 1888 he was selected and served until 1896 as the secretary of the Democratic National Committee. In whatever station he occupied, to whatever post he was chosen, he demonstrated that he was in every case equal to the demand. His rise in and his successful civic career are admirable illustrations of the great possibilities that lie within the reach of the Amercan youth endowed with a clear head, a brave heart and a strong right arm.

"His private life was clean. His habits were above reproach. Always genial and affable, he was none the less, when occasion demanded it, brave, assertive and tenacious. He was generous and forbearing and his heart overflowed with sympathy for others whom sorrow or misfortune had overtaken. But above all things he was loyal and true. Once admitted to his friendship, he bound you with bands of steel. Nothing could make him do a dishonest act or join with others in a questionable transaction. He held that the faith and trust of his friends were dearer to him than money or any kind of preferment.

"In his death independent telephony has suffered an overwhelming and incalculable loss. Were he living he would still be with us shoulder to shoulder in the great struggle for fair competition and clean, wholesome business methods."

Chicago's Civic Federation Against Municipal Ownership.

The Civic Federation of Chicago at its recent biennial meeting adopted a sharp report against the municipal ownership "frenzy" and said:

"When the city council legislative committee undertook to draw a bill, which, when passed by the general assembly, would give the city the right to increase its bonded indebtedness," said the report as adopted, "it was hoped that the bill would include all reasonable restrictions with respect to the annual increase in the bonded indebtedness and with respect to the character of permanent improvements to be purchased by the proceeds of the sale of such bonds. Not only were safeguards of every kind omitted, but the city council asked for the right to become indebted in a sum equivalent to 5 per cent of the full value of taxable property, and it is also asked in the same bill for the right to manufacture and sell gas and electricity for light, heat and power, and also for the authority to engage in the telephone business.

"The bill as approved by the city council in so many words asked the general assembly for the right to increase the debt of Chicago $45,000,000, and gave notice that this amount—all, or a portion of it, as the wisdom of the council might dictate—might be used, not for permanent improvements, such as schoolhouses, pumping stations, and so forth, but to build gas works, electric lighting stations, telephone exchanges, street railways, etc. The measure fairly represented the sentiment of a portion of the Chicago press and a considerable portion of the Chicago people who are outspoken in favor of municipal ownership, but in the judgment of the Civic Federation it was not a measure which the business community or any thoughtful citizen could possibly indorse.

"The executive committee is unanimously opposed to municipal operation of public utilities, and it regards municipal ownership of any of them under present conditions as impracticable. It does not feel that in the nature of things the city can possibly be successful in the management of any of the so-called public utilities.

"The city has had the management and control of the water department and the electric system for lighting for a good many years, and it cannot be said that, in connection with the water department, at least, it has been successful. More than half of the entire output of the pumping stations is sold on what is known as a flat rate, and is not metered. The flat rate system of selling water is extravagant, wasteful and unfair alike to the city and to the consumer. The rate for water in Chicago is supposed to be about 8 cents for each 1,000 gallons. Last year Chicago pumped 137,515,751,956 gallons. The receipts amounted to 2¾ cents a thousand gallons. If 8 cents for each 1,000 gallons is a fair charge, and if the present service is laid out on a basis of 8 cents for each 1,000 gallons, it is plain that two-thirds of the water is being wasted. We feel that in the reorganization of the pumping, the distributing and merchandizing of the water alone the present administration has a tremendous problem on its hands, which will take considerable time to work out."

The report began its reference to the city electric plant by saying: "The plant has been in operation some fifteen years. It has been successfully and satisfactorily managed throughout. The cost of operating the 5,000 arc lamps owned by the city, adding interest and depreciation, together with the loss of taxes and other proper charges, is in the aggregate $625,000 per annum. On a contract running for a long period with a private corporation the same service doubtless can be had at from $400,000 to $450,000 per annum. As an illustration of the difficulties of municipal ownership and operation the following statement from the report of the electric department, 1904, is interesting: 'It seems impossible to make any substantial reduction in the total cost because of the constantly increasing cost of labor. The average rate of pay to employees is far above that paid by private corporations for the same class of work.'

"Further testimony as to the difficulty of operating the municipal plant, from the standpoint of labor, is in the experience of the department within the past few weeks when it has been compelled to put the wages of lamp trimmers at a uniform price of $75 a month regardless of the character of the work done by the trimmer or the length of his experience in that kind of work.

"The Civic Federation maintains, therefore, that in the management of the two classes of service referred to, the city has not been so successful that it can either expect or claim the right to be permitted to go into the street railway business, the furnishing of telephone service or the manufacture and distribution of gas or electricity."

CURRENT NEWS AND NOTES.

INDEPENDENT TELEPHONE SIGN.—The distinctive Independent telephone sign adopted at the recent convention of the National-Interstate Telephone Association consists of a shield in red, white and blue with a white circle surrounded by a solid blue field.

CORRECTION OF ERROR.—In the article in our issue of June 17 by Mr. Clarence P. Fowler, entitled "External Reactance for Synchronous Converters," the captions of Fig. 3 and Fig. 4 were interchanged. Fig. 3 refers to leading, and Fig. 4 to lagging, current, instead of the reverse, as indicated by the captions.

ELECTRIC ORE SMELTING.—It is stated that the Dominion government has appropriated $15,000 for the purpose of making experiments with the electric process of smelting ores and manufacturing steels. The experiments will take place at the plant of the Consolidated Lake Superior Company, which concern will supply 400 hp for four months without charge.

THE BARNARD MEDAL has been awarded this year by Columbia University, New York City, to Henri Becquerel, of Paris, France, in recognition of his important discoveries in the field of radio activity and for his discovery of the dark rays from uranium. The award comes once in five years, and has been made on the nomination of the National Academy of Sciences.

"ENGINEERS IN AMERICA."—Mr. Ernest C. Brown, editor and publisher of *Progressive Age*, who is issuing the biographical work entitled "Engineers in America," reports encouraging advances toward completion. He has already received data from 2,000 engineers, and expects details from or in regard to the majority of some five or six hundred more. The work of editing is now in hand.

FRENCH CABLE IN VENEZUELA.—The picayune president of Venezuela now claims that he holds evidence to prove that the French Cable Company aided General Matos in his recent revolutionary schemes and actions, and he is trying to prove that it has failed to carry out the terms of its cable concessions. This sounds like a new plan for exacting blackmail and embroiling the nations.

WIRELESS IN SOUTH PACIFIC.—The International Telegraph Construction Company is said to have submitted a scheme to the Postmaster-General of Australia for the erection of wireless telegraph stations linking New Zealand and Australia direct, and also via Tasmania or Lord Howe and Norfolk Islands, and establishing communication between Queensland and Port Moresby and Samari, in Papua.

NEW SOUTH AMERICAN CABLE.—The Central & South American Telegraph Co. has contracted with Siemens Bros. & Co. of London for the laying of a duplicate cable between Chorillos, Peru, and Valparaiso, Chili, touching at Iquique. The contract stipulates that the cable be laid and in operation before March 1 next. Its cost, with new instruments and apparatus required, is estimated at $988,000.

LECTURES AT UNIVERSITY OF MINNESOTA.—The closing non-resident lectures before the electrical engineering department of the University of Minnesota were given by Mr. Benjamin Waller, chief engineer of the Northwestern Telephone Company; Mr. A. L. Rohrer, electrical superintendent of the Schenectady Works of the General Electric Company, and Mr. Chas. L. Pillsbury, consulting engineer, St. Paul. Mr. Waller discussed the growth of the telephone business since its beginning in 1876, showing the intimate relations between the engineering and economic problems in telephony, and the importance of a thorough knowledge of human nature. He emphasized the possibility and the desirability of good engineering in telephony. Mr. Rohrer showed a large number of views of the works of the General Electric Company, and explained the operation of its student apprentice system. Mr. Pillsbury discussed the importance of the "Electric Motor in Modern Industries," showing the reasons for its rapid adoption in shop driving, its convenience and economy being of no less importance than the ability to arrange a factory with reference to the most economical handling of material. Numerous slides illustrated the use of the motor in various industries, special attention being given to the advantages of variable-speed motors.

THE GOVERNMENT AND WIRELESS.—A special dispatch to the New York *Tribune* of June 24 says: "The wireless experts of the government are applying themselves with energy to the problem of getting rid of the influences which are destined to interfere with that form of communication in time of war, or at least to prevent secret exchange of messages. There have been many assurances that this would be possible by means of special devices used, but it is found that the wireless stations along the coast obtain many messages, in whole or part, which are not intended for them. Thus, at the Washington Navy Yard recently there were received messages evidently being exchanged between ships in distant Southern waters. There is nothing to account for this irregularity in the action of the messages; so much depends upon the wave influences. At the same time, it is realized that something must be done toward a regulation of the wireless communication. Much may be accomplished by governmental control, but this may not be possible, now that the wireless companies are fully organized and have sold stock to people who may feel that their interests would not be helped by legislation along the lines suggested by the special joint board of which Rear Admiral Evans was the senior member. There is also much to be obtained from an international discussion of the subject, but this appears to be out of the question during the war between Russia and Japan and until the British and Italian governments adjust their relations with the Marconi people."

TORONTO BRANCH OF THE INSTITUTE.—The following-named officers were elected at the recent annual meeting of the Toronto branch of the American Institute of Electrical Engineers: H. A. Moore, chairman; R. G. Black, vice-president; R. T. MacKeen, secretary. Executive committee: W. A. Bucke, J. A. Price and K. L. Aitken.

ELECTROTECHNICAL INDEX.—The Association Presse Technique, 1 rue de Musée, Brussels, Belgium, has added to the several indexes which it prints, a monthly electrotechnical index in English and French, printed on only one side of a sheet for card index purposes. The subscription price is $1.00 per annum, and a specimen copy will be sent free upon application.

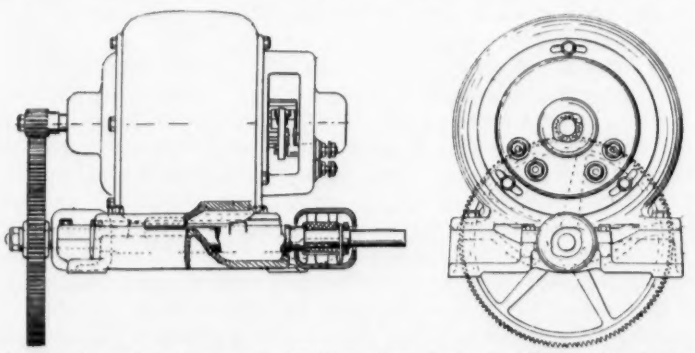
MARCONI AT POLDHU.—Signor Marconi is at the Poldhu, England, station supervising the installation of apparatus which is practically a duplicate of that installed at Glace Bay, Nova Scotia. The Canadian station, it is said, will be completed in a very short time, and interests of the Marconi Company declare that this warrants the belief that transatlantic service will be established in the near future.

NEW YORK LIGHTING COMMISSION.—The Governor of New York has nominated three men for the new State Lighting Commission. The salary is $8,000 a year each. The nominees are Messrs. James R. Sheffield, of New York City; B. B. Shedden, of Plattsburg, and John C. Davies, of Camden, Oneida County. None of them has any technical acquaintance with the subject, but all are well known in politics, particularly Mr. Sheffield, who was formerly fire commissioner of New York under Mayor Strong. It is not yet sure that all will accept and be confirmed. Mr. Sheffield is understood to have declined.

CHICAGO'S MUNICIPAL RAILWAYS.—A despatch from Chicago says: It begins to look as though the traction question with its side issue of municipal ownership will outlast the term of Mayor Dunne. The whole plan of sale to the city hinges on the result of the legal contest as to the value of the 99 year act. Until the Supreme Court has passed on this measure the value of traction stocks and bonds cannot be estimated. Pending this long delayed decision the city can take a minor hand in running the companies and cost of improvements will be added to the final bill when municipal ownership obtains.

GOVERNMENT CONTROL OF ELECTRIC POWER.—Government ownership of the Canadian Niagara Falls power and the transmission lines in connection therewith, is the bold enterprise that many prominent citizens of Ontario expect to see carried out by the new local government of the province. The report of the commission appointed by the municipalities of Ontario lying within a hundred miles of the falls, to inquire into the best means to be adopted to secure cheap power, will be made public shortly, and sufficient has been let out to warrant the statement that the commission will recommend that the government make the development and transmission of power a public enterprise.

COUNTERSHAFT FOR MOTORS.—In order to eliminate the need of special frames for such motors as are to have countershafts, Mr. E. R. Douglas, according to a patent issued June 20, proposes to mount the countershaft on a special bedplate to which a motor of



standard construction can be bolted when desired. When this design is used it becomes unnecessary for manufacturers to carry in stock entire motors constructed both with and without countershafts.

HISTORY OF THE TROLLEY.—One of the best popular technical articles seen in a long time is that by Mr. Frank J. Sprague on the American electric railway and trolley system, in the *Century Magazine* for July. The first part appearing in that issue is a brilliant and fascinating narrative of great achievement in an industry on which the American public now spends $300,000,000 every year in fares. Mr. Sprague's article is admirably illustrated with sketches and with portraits of his leading contemporaries in the same special field of work. It is understood that this notable article is one contribution in a series of an autobiographical nature, to which Mr. C. F. Brush has already contributed one on the arc lamp. When complete this series if maintained at its present high level of interest and value should be put into book form.

TAXES ON ELECTRICIY.—A special dispatch from St. John's, Newfoundland, of June 11 says: "Premier Bond, in the Legislature yesterday afternoon, announced plans for raising increased revenue. He said the Canadian Marconi Company had established three wireless stations in Newfoundland without authority, and the Colonial Government believed they were now doing commercial business with the Marconi stations at Cape Cod, Cape Breton, and passing steamers. Therefore the Government proposed to tax these stations $4,000 each if satisfied that such business was being done. The Premier also stated that it was not the intention of the Government to tax the Anglo-American Cable Company for more than five Atlantic cables at $4,000 each, as the extensions to the Canadian Continent were regarded as part of the same cables."

RADIUM AND NEW LIFE.—A special cable dispatch of June 24 to the New York *Evening Post* says: "The greatest interest has been excited by the discovery of Prof. John B. Burke, of the Cavendish laboratory, which may be summarized thus: After years of negative experimentation on the phosphorescence of cyanogen, which Pfluger declared to contain the element of life, Mr. Burke resolved to test it with radium, and placed it in the test tube with sterilized bouillon. After a couple of days cultures were obtained of atoms which subdivide on reaching a certain size. Placed upon fresh portions of sterilized bouillon, these growths continue to grow slightly, thus showing that the influence of the radium is only initiatory. Prof. Sims Woodhead pronounced them neither bacteria nor crystals; but they present many appearances of vitality and seem to indicate the possibility of spontaneous generation. Mr. Burke contends that the experiment is not in the least destructive of the Deistic conception of the universe. 'In fact, if it can be shown that dust and earth can produce life, on account of their radio-activity, it would only confirm the truth of Biblical teaching.' Leading men of science maintain an attitude of reserve as to the vitality of Professor Burke's radiobes."

PURIFICATION OF WATER.—Mr. R. Guenther, U. S. Consul-General at Frankfort, Germany, says: "The *Frankfort News* states that it is probable that electric purification of drinking water will soon be introduced into the home. This method, already used by a number of municipal waterworks, is based upon the germ-killing effects of ozone, which is cheaply engendered by electricity. If an electric discharge takes place between two glass tubes, one inside the other, whose surfaces facing each other are coated with metal, ozone is developed in the space between the tubes. Electricians have tried in recent years to simplify the means of electric ozone development for purifying water. The ideal apparatus would be one which every housekeeper could put up in the kitchen, and by utilizing the electric current of the common electric light wires purify every glass of drinking water. According to the *Frankfurter Umschau*, such an apparatus seems to have been successfully made by a French engineer, Mr. Otto. This apparatus is of very simple construction and takes up little space. It consists principally of a small, closed box, the metal cover of which is made conductory with the bottom. In the box is an ozone developer, an interrupter, and a tin tube. Through the later the ozone, which first has to pass through a cotton stopper to free it from dust and germs contained in the air, is conducted into the water and mixed therewith. If much ozone has been absorbed, the water becomes phosphorescent in the dark. The most important part of the apparatus is the "mixer," action of which can be interrupted at will. The apparatus is capable of purifying about 60 gallons of water an hour, and the cost per hour is about the same as that of an ordinary electric incandescent light."

MEXICAN 30,000-VOLT PLANT.—The electric lighting plant at Morelia, state of Michoacan, Mexico, has been purchased from the state by Messrs. Ibarralo, Gonzales y Ca, and will be known hereafter as the Sociedad Moreliana de Fuerzo Hidro-Electrica. The new company is now installing a plant about 24 miles from the state capital, utilizing a water power of 800-ft. head and capable of generating 1800 horse-power. The transmission will be at 30,000 volts, three-phase. The new plant will be put in operation about August 1.

STARTER FOR VAPOR LAMP.—In a patent issued June 20 to Mr. W. R. Whitney is disclosed a novel form of electrode of a vapor lamp combined with means for producing an arc in the vapor. The active material of the electrode is mercury, but in order that it may be rendered capable of being acted upon magnetically, a small amount of iron is added thereto. A carbon filament extends from the top electrode nearly into engagement with the bottom electrode of iron amalgam. An electromagnet serves for banking the fluid amalgam electrode until it comes into contact with the carbon filament. When current flows through the filament a switch, operated by the current, opens the circuit to the magnet coil, and the amalgam resumes its former level and an arc is started in the vapor. This arc extends instantly along the filament to the upper electrode.

ARTIFICIAL RESISTANCE.—It has been found in practice that when resistance rods are made of carbon dust with some binding substance, some of the rods, which are to all appearances identical with others, may differ in resistance by 75 per cent. or more. In a patent issued June 20 to Mr. W. R. Whitney, it is stated that the conductivity resides very largely in the surface coating of the rod. When this coating is removed the conductivity is largely reduced, and the resistances of the rods become almost uniform. The inventor proposes to remove the surface coatings of carbon dust by exposing the rod to an intense heat in the presence of air. When rods thus formed are provided with a moisture-proof coating, they become especially advantageous for use in lightning arresters, on account of their high resistance and because of the fact that they are not subject to permanent alteration of conductivity by heat.

TIME OF STARTING A STEAM TURBINE.—At the recent Scranton meeting of the American Society of Mechanical Engineers, Mr. A. S. Mann, of Schenectady, presented a paper giving the result of observations on the time required to start a Curtis steam turbine. The turbine is of 1500 kw. capacity, condensing, of course, and supplied from boilers which also supply steam for other purposes; upon starting up the turbine it is necessary, however, to pass from the condition of slow fires to forced fires. The time observed was that from sounding a whistle calling a scattered force to stations, to the time when the turbine was cut into circuit. Three or four pumps must be used in starting off each pair of turbines, and also an exciter driven by a small steam engine. The record book shows that of 43 calls for sudden starting up, 10 starts were made in 2½ minutes, 18 in three minutes and 15 in 3½ minutes. In a number of instances when all of the auxiliaries were in motion, the turbine was started and connected to line in from 45 seconds to 1½ minutes. Two starts in 45 seconds were made on the turbine when it had stood for 24 hours with the throttle valve shut, but with a slight leakage past the seat. After the throttle valve is off its seat it does not require more than 30 seconds to bring a turbine up to speed. The author states that to start a large steam engine from cold state requires from 12 to 15 minutes and from a hot state 5 minutes.

Electrical Engineers of the Times—XVI.

MR. F. F. FOWLE.

Frank Fuller Fowle was born November 29, 1877, at San Francisco, Cal. When three years of age, his family moved to Hancock, N. H., where he attended country schools until, at the age of eleven, he entered the Boston public schools. He graduated from the Grammar grade in 1893, and after spending two years in the Mechanic Arts High School, entered the Massachusetts Institute of Technology in 1895, from which he graduated in 1899 with the degree of Bachelor of Science in Electrical Engineering.

During the summer of 1898 Mr. Fowle had charge of an isolated electric light plant, and the following year entered the engineering department of the American Telephone & Telegraph Company in New York, under Mr. Frank A. Pickernell, engineer, as assistant electrician. He remained in this department four years, during which time he was engaged in work on transportation systems under the pioneer in this field, Mr. John A. Barrett. He made a special study of the question of joint occupancy of pole lines by telephone and electric light systems and devised a general system of transpositions to overcome inductive disturbance. He also took up laboratory work on common battery trunking systems and their design, the design of power plants for telephone exchanges and the preparation of specifications for the same, and was in charge of acceptance tests on generators, motors, motor-generators and rotary transformers.

Some months in 1901 were spent in assisting in a very elaborate investigation of transmission with the common battery system under service conditions, in five principal cities, in an analysis of traffic records and methods of handlng toll business, and in preparing several reports on printing telegraphy and multiplex manual telegraphy. The following year he was engaged for several months in connection with the application of Dr. Pupin's method of inductance loading of long aerial lines, the use of such lines for simultaneous telephony and telegraphy, both in cables and open wire lines, and in

F. F. FOWLE.

comparative tests of transmission over long loaded lines. In 1903 he entered the Railway Department of the same company as special agent, and engaged in introducing the system of compositing grounded telegraph circuits, known as the "railway composite." Later he took up the building of railway telephone lines and systems, acting in an advisory capacity on matters of design and construction, including the design of long lines and special equipment for use therewith, the preparation of specifications and estimates for construction, and work on telephone train dispatching systems and special uses of the telephone in the railway service.

Mr. Fowle has been identified with the telephone development on several important railroad systems, including the New York Central & Hudson River Railroad, the Lake Shore & Michigan Southern Railway, the Baltimore & Ohio Railroad, the Chesapeake & Ohio Railway, the Pittsburg & Lake Erie Railroad, the Long Island Railroad, and the Lehigh Valley Railroad. In 1903 he read a paper before the New Orleans convention of the Railway Association of Telegraph Superintendents, on the "Transposition of Telephone Lines: Cross-Talk and Induction," which formed an important contribution to the subject and was reprinted in these columns and in several telephone journals. He has contributed articles to the technical press on "The Measurement of Distributed Leakage on Transmission Lines" and "An Alternating Current Relay for Low Frequencies," and presented a paper on "The Transposition of Electrical Conductors" at the October, 1904, meeting of the A. I. E. E., and another entitled "The Railway Telephone Service; Cost of Line Construction," at the Chattanooga, 1905, convention of the Association of Railway Telegraph Superintendents.

Mr. Fowle is a member of the American Institute of Electrical Engineers, the Railway Signal Association, the Association of Railway Telegraph Superintendents, the New York Telephone Society and the Technology Club of New York.

Transmission of Niagara Power to Toronto.—I.

TWO lines of steel towers on a private right of way 75 miles long are to carry four circuits for the transmission of 40,000 horse-power at 60,000 volts from Niagara Falls to Toronto.

On this right of way the minimum standard width is 80 feet, the grade toward Toronto is not expected to exceed 15 feet per mile, and toward Niagara Falls 53 feet per mile, and the rate of curvature will not be more than 3½ degrees, or a radius of 1,637 feet. These figures for grade and curvature are especially important because a high-speed electric railway is to be operated with double tracks between the two rows of steel towers along the entire length of the line.

Between the two lines of towers the clear width of the right of way is 34 feet, the centers of the double tracks are 13 feet apart, and the distance from the center of each track to the sides of the nearer towers is also 13 feet. From the center of each tower to that of the right of way is 24 feet, and the two lines of towers thus have their centers 48 feet apart. At the ground line the width from outside to outside of the tower lines is 62 feet, but at the level of the crossarms the width is 67 feet 6 inches. At present one line of these towers with its two transmission circuits is nearly completed, and the other line of towers will be erected as soon as the demand for power makes it desirable.

On the straight portions of the line the steel towers are regularly erected 400 feet apart, but on curves the distances are less between towers, so that their total number is about 1,400 for each line. Standard curving along the line requires towers placed 50 feet apart, and a change in direction of not more than 10 degrees at each tower, except at the beginning and end of the curve where the change in direction is 3 degrees. When the change in direction of the line is not more than 6 degrees the corresponding spans allowed with each change are as follows:

Degrees change.	Feet of span.	Degrees change.	Feet of span.
½	300	3½	219
1	286	4	205
1½	273	4½	192
2	259	5	178
2½	246	5½	165
3	232	6	151

If the line follows a rising grade with a span of 200 feet the elevation of the first tower beyond the level may be 7 feet above the one preceding, the elevation of the second tower 14 feet, with 21 feet rise between the second and third tower, 28 feet between the third and fourth, and a line that follows an up grade with a span of 300 feet may rise 24 feet in the first span beyond the level, 48 feet in a distance of 400 feet between towers, the rise of the first span beyond the level may be as much as 56 feet, of the second 112 feet, of the third 168 feet, and so on.

At the same points along the line conditions require a span between towers of more than 400 feet, the regular distance for straight work. One example of this sort occurs at Twelve Mile Creek, where the stream has cut a wide, deep gorge in the Erie plateau. At this point the lines makes a span of 625 feet between towers. In the case of this long span, as in some others, it is not thought desirable to have the transmission circuits at either side of the electric railway, and the right of way is therefore widened so that the towers can be set at one side. For the crossing at Twelve Mile Creek the center line of the nearer line of towers is moved to a distance of 63 feet to one side of the center line of the electric railway, and the distance between the centers of the two lines of towers is reduced to 30 feet. To provide for this sharp offset a special form of tower is provided.

The regular steel tower used in this transmission measures 46 feet in vertical height from its foot to the top of the lower insulators, and 51 feet 3 inches to the tops of the higher insulators. The lower six feet of this tower are embedded in the ground, so that the tops of the insulators measure about 40 feet and 45 feet 3 inches respectively above the earth. At the ground the tower measures 14 feet at right angles to the transmission line, and 12 feet parallel with it. The width of each tower at the top is 12 feet at right angles to the line, and the two sides having this width come together at points about 40 feet above the ground. Between the two L bars thus brought nearly together at each side of a tower a piece of extra heavy 3-inch steel pipe is bolted so as to stand in a vertical position. Each piece of this pipe is about 3½ feet long and carries a steel insulator pin at its upper end. The two pieces of pipe thus fixed on opposite sides of the top of a tower carry the two highest insulators. For the other four insulators of each tower, pins are fixed on a piece of standard 4-inch pipe that serves as a crossarm, and is bolted in a horizontal position between the two nearly rectangular sides of each tower, at a point two feet

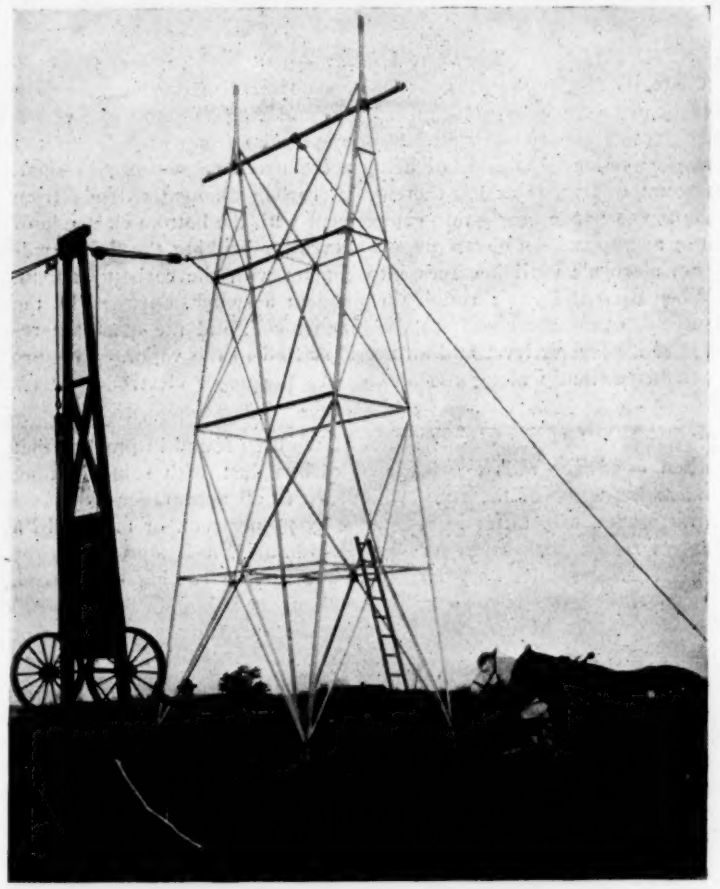
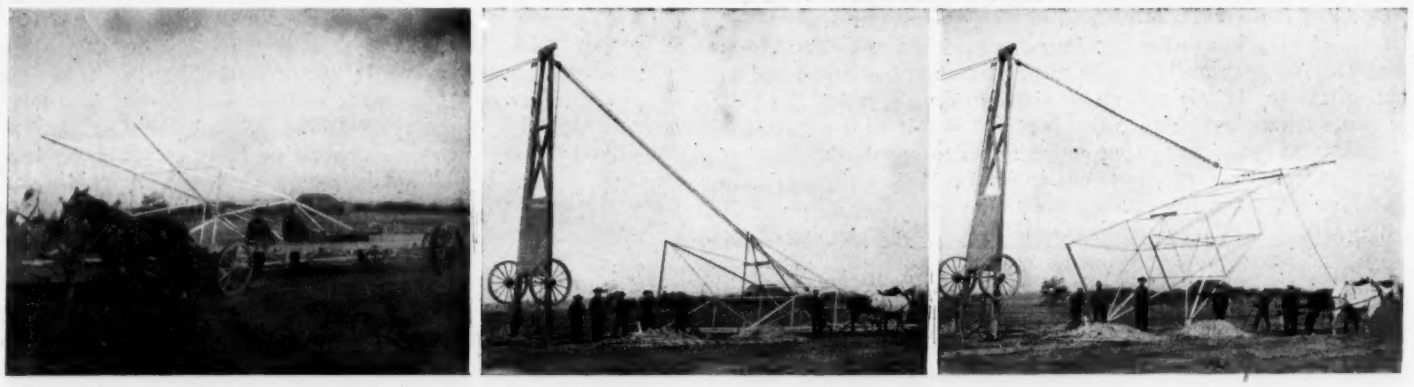


FIG. 4.—ONE OF THE TOWERS IN POSITION.



FIGS. 1, 2 AND 3.—RAISING TOWERS ON NIAGARA TRANSMISSION LINE.

below the bolts that hold the vertical 3-inch pipes already named in position. Save for the two short vertical and one horizontal pipe, and the pins they support, each tower is made up of L-shaped angle bars bolted together. Each of the two nearly rectangular sides of a tower consists of two L bars at its two edges, three L bars for cross braces at right angles to the edges, and four diagonal braces also formed of L bars. The lower halves of the L bars at the edges of each side of a tower have sections of 3″ x 3″ x ¼″, and the upper halves have sections of 3″ x 3″ x 3/16″. This last named cross brace, and the other two cross braces have a common section of 2″ x 1½″ x ⅛″. For the lower set of diagonal braces the common section is 2½″ x 2″ x ⅛″, and the upper set has a section of 2″ x 1½″ x ⅛″ in each member. At the level of the lowest cross

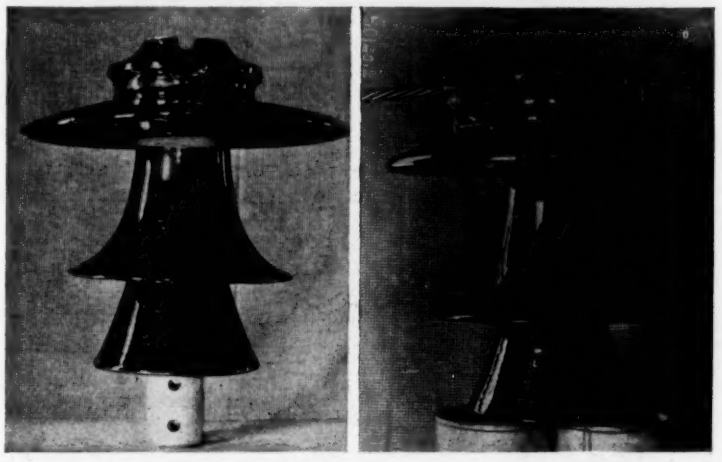


FIG. 5.—INSULATORS.

braces the two rectangular sides of a tower are tied together by one member of 2″ x 1½″ x ⅛″ of L section and at right angles to the sides, and by two diagonal braces of ⅝″ round rod between the corners of the tower. On each of its two triangular sides a tower has four horizontal braces, and three sets of diagonal braces. The two upper horizontal braces are of 2″ x 1½″ x ⅛″ L section, and the lowest is the same, but the remaining horizontal brace has a section of 2½″ x 2″ x ⅛″. Bars of 2″ x 1½″ x ⅛″ L section are

FIG. 6.—GENERAL VIEW ALONG NIAGARA TRANSMISSION LINE.

used for the two upper sets of diagonal braces, and bars of 2½″ x 2″ x ⅛″ for the lower set. In addition to the cross braces named, each triangular side of a tower near the top of the corner bars has two short cross pieces with the common L section of 3½″ x 3½″ x ⅝″, one just above and the other just below the crossarm of 4-inch pipe to hold it in place. At the bottom of each of the four corner bars of a tower a foot is formed by riveting a piece of 3″ x ¼″ L section and 15 inches long at right angles to the corner bar. On one corner bar of each tower there are two rows of steel studs for steps, one row being located in each flange of the L section. On the same flange these steps are 2 feet apart, but taking both flanges they are only one foot apart. Every part of each steel tower is heavily galvanized.

The labor of erecting these steel towers has been reduced to a low figure by the method employed, as shown in the accompanying illustration. Each tower is brought to the place where it is to stand with all of its parts assembled, save that the extensions of the legs that go into the ground are detached. These extension pieces are first fixed in the ground with their ends projecting to receive the legs of the tower. For hauling the towers a four-wheel wagon with a timber body about 30 feet long is used. When it is desired to raise a tower, two of the wheels with their axle are detached from the timber body of the wagon, and this body is then stood on end to serve as a sort of derrick. This derrick is guyed at its top on the side away from the tower, and a set of blocks and tackle is then connected to the top of the derrick and to the tower at a point about one-fourth of the distance down from its top. A rope from this set of blocks runs through a single block fixed to the base of the derrick and then to a team of horses. On driving these horses away from the derrick the steel tower is gradually raised on the two legs of one of its rectangular sides until it comes to a vertical position. The next operation is to bring the legs of the tower into contact with the extension pieces that are fixed in the earth, and then bolt them together.

Magnetic Non-Iron Alloys.

Prof. J. A. Flemings and Mr. R. A. Hadfield, in a recent Royal Society paper, give the latest results of their work of investigation of the magnetic qualities of some alloys not containing iron. The alloy experimented with was composed of manganese, 22.42 per cent; copper, 60.49 per cent; aluminum, 11.65 per cent; carbon, 1.5 per cent; silicon, 0.37 per cent; iron, 0.21 per cent. About 2 or 3 per cent of slag was intermingled, mostly consisting of manganese and silicon oxides, with slight traces of metals other than the above mentioned. The conclusions of the paper are as follows:

The above alloy exhibits magnetic properties which are identical with those of a feebly ferro-magnetic material.

The magnetization curve is of the same general form as that of a ferro-magnetic metal such as cast iron, and indicates that with a sufficient force a state of magnetic saturation would most probably be attained.

The alloy exhibits the phenomenon of magnetic hysteresis. It requires work to reverse the magnetization of the material and to carry it through a magnetic cycle.

The material has a maximum permeability of 28 to 30, which is not greatly inferior to that of the values reached for cobalt or a low grade of cast iron for small magnetic forces, and occupies a position intermediate between the permeability of the ferro-magnetic and the merely paramagnetic bodies, such as liquid oxygen and ferric chloride.

The material exhibits, therefore, the phenomenon of magnetic retentivity and coercivity. It is not merely magnetic, but can be permanently magnetized.

A further conclusion is that the magnetic properties of this alloy must be based on a certain similarity of molecular structure with the familiar ferro-magnetic metals. The hypothesis which best fits the facts of ferro-magnetism is that materials such as iron, nickel and cobalt, are composed of molecular groups which are permanently magnetic, and that the process of producing or changing the evident magnetization of a mass of these metals consists in arranging or disturbing the positions of these molecular magnets. Since, then, we have in this alloy an instance of fairly strong ferro-magnetism produced by an admixture of metals possessing in themselves separately no such property, it follows that ferro-magnetism *per se* is not a property of the chemical atom, but of certain molecular groupings. The importance of this fact cannot be easily overstated. It shows us that in spite of the fact that ferro-magnetism has been hitherto regarded as the peculiar characteristic of certain chemical elements—iron, nickel and cobalt—it may, in fact, depend essentially on molecular grouping composed of a comparatively large number of molecules, and, hence, it may be possible to construct alloys which are as magnetic or even more magnetic than iron itself.

Commenting on the paper, our London contemporary, the *Electrician*, says that the discovery of the secret of the molecular grouping referred to would be of immense importance, as it will lay bare the whole mystery of magnetism, and might make possible the manufacture of a material even more magnetic than iron itself.

Electric Spark Recorder.

BY F. W. SPRINGER.

THE difficulty experienced in obtaining accurate records of the readings of current, voltage, watts, speed, etc., of railway motors, electric elevators and the like induced the writer to attempt the construction of a device which would record their instantaneous values. After considerable experimenting, the device, substantially as shown in Fig. 1, was constructed. This apparatus, which has been in use in various forms in the electrical laboratory at the University of Minnesota during the past six years, has proven very successful for the purpose for which it was intended. As it may be made up of a combination of instruments in common use in electrical laboratories, it is hoped that a description of it may be of interest to others who have occasion to obtain instantaneous records.

As shown in Fig. 1, two cylinders are mounted on the drum of an ordinary chronograph. Each cylinder is five and one-half inches long, and is insulated from the drum by fibre rings of a uniform thickness of one-fourth of an inch. The adjoining ends of the two "tin" cylinders are separated from each other by a space of three-eighths of an inch. It is sometimes convenient, however, to bring the ends of the cylinders together, making one cylinder, when current or voltage alone is recorded. The cylinders are roughened with coarse emery cloth and not lacquered or painted.

The covers being removed from a Weston direct-current portable voltmeter and from a separate shunt ammeter of similar type, the

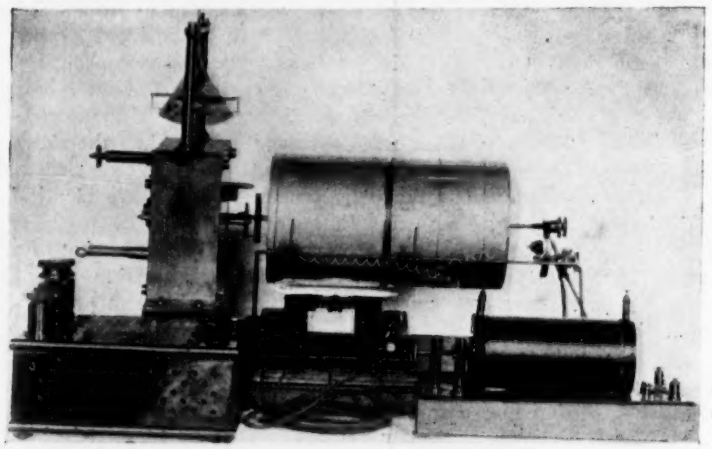


FIG. 1.—ASSEMBLY OF RECORDING APPARATUS.

ends of the pointers of the instruments were fitted with light aluminum spark-points of such length that the covers could be replaced without interfering with the free movement of the pointers. Each spark-point was made by hammering a small aluminum wire to the thickness of the end of the pointer, and by trimming it to about one-sixteenth of an inch in width. This was split and set on the pointer, as shown in Fig. 2, and the top clipped off to the proper length. Two instruments were then placed under the two insulated cylinders, respectively, in such positions that when the pointers stood at one-fourth and three-fourths of the full scale reading, the spark-points would be directly under the axis of the cylinders and about one-sixteenth of an inch from the paper with which the cylinders were covered. The distance between the points and the paper is a maximum at zero, half scale and full scale readings. It is very desirable to have the gaps between the spark-points of the instruments and cylinders as small as possible and of the same length for all readings. For this reason a drum of large diameter gives best results.

An insulated spark-point is set on a rod in front of each cylinder within one-thirty-second of an inch of the paper. Two induction coils, such as vibrator jump spark coils for gas engines, are connected as shown in Figs. 2 and 3. One of the secondary terminals of one of the induction coils is connected to that binding post of the ammeter which is in immediate connection with the pointer of the instrument, and the other is attached to the spark-point on the rod at the side of the cylinder. Each discharge makes two holes in the paper, one opposite the spark-point of the instrument pointer which records the readings of the instrument, and the other opposite the fixed point. Two lines of holes are, therefore, made in the record paper; one more or less irregular, corresponds to the movements of the instrument pointer; the other, being straight, is used as a base line.

The second induction coil is similarly connected to the voltmeter,

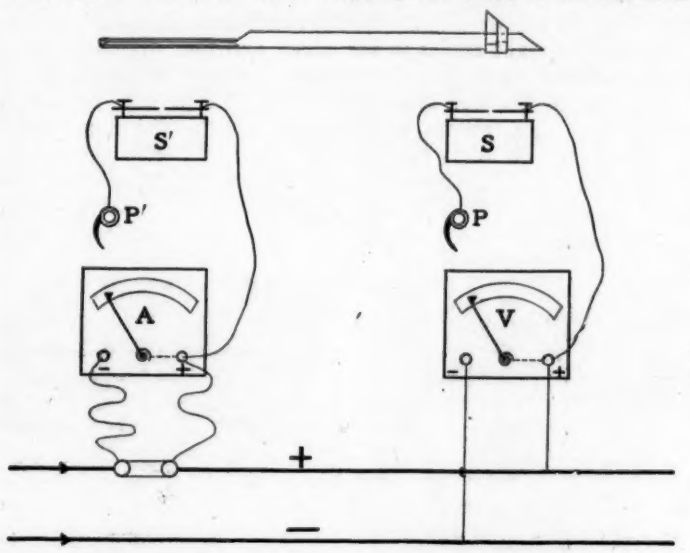


FIG. 2.—SPARK POINT AND ITS CONNECTION IN CIRCUIT.

as shown in Fig. 2. When both instruments are used, it is essential that care be taken to put the ammeter on that side of the line with which the voltmeter pointer is in immediate connection, in order that there may be no difference of potential between the pointers of the ammeter and voltmeter, thus avoiding any possibility of a short circuit between the two instruments.

The number of holes made by the sparks per inch of record paper depends upon the speed of the paper and the pointer and the construction and adjustment of the vibrator of the coil. In an extreme case the holes need never to be more than an eighth of an inch apart. With a slow-speed record and a fat spark, the paper will be burned so that the curves can easily be seen, otherwise they may be traced in pencil while holding the record between the observer and a strong light.

Due to the fact that the resistance of the spark is only a few ohms, so that there is only a comparatively small difference of potential between the cylinder and the pointer, the stream of sparks from

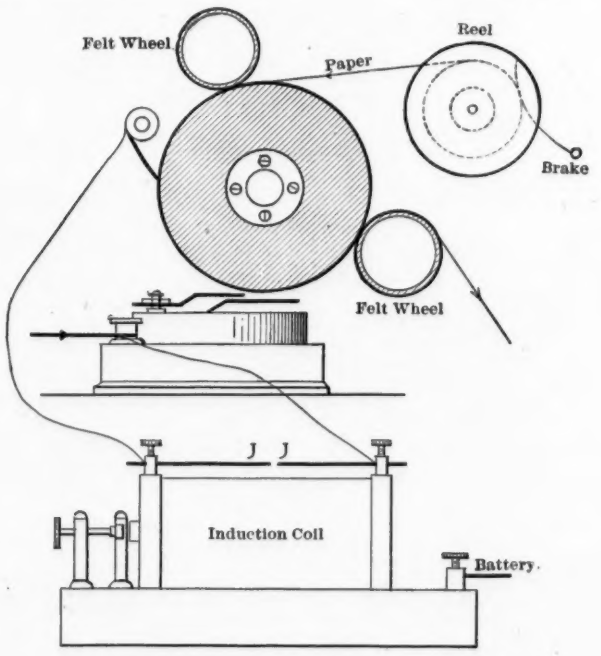


FIG. 3.—DIAGRAM OF RECORDING CIRCUITS.

the pointer does not affect the readings appreciably by static attraction between the drum and the pointer. The spark-points, *J J*, Fig. 3, are very essential. They should be set so that the gap will be a little greater than the sum of the two gaps through the record paper.

Fig. 3 shows one arrangement of the apparatus as used for obtaining continuous records. The upper roller carries a long strip of ordinary white wrapping paper which is passed around a main cylinder, and under two felt-covered wooden wheels. The first felt wheel forces the paper down on little brads, which are soldered at intervals around the cylinder to prevent slipping.

A chronograph serves to regulate the speed of the paper, and a clock gearing attached to the other end of the main drum overcomes the friction of the drums and the brake. Where only one cylinder is used, as in acceleration and slow-record tests, the single recording drum may be mounted on pivots and operated by being properly geared to a good strong clock, and if necessary, the friction may be partly overcome by the use of a weight and cord or by a clock spring and gearing.

For various tests or electric cars, the drum may be so geared to the car axle that the speed of the paper varies directly with the car speed. In such cases it is necessary to use a "timer," as is also the case when it is impossible to adjust the chronograph or clock to regulate at a sufficiently constant speed. As a timer there is used an electro-magnet attached to the rod carrying the zero spark-points, or to a pencil in contact with the record paper, in such a way that a short line is made on the record paper when the magnet is energized. The magnet is operated by a dry cell whose circuit is closed by a device consisting of two clocks which closes the circuit every fifteen seconds. For work other than that on cars, the best timer consists

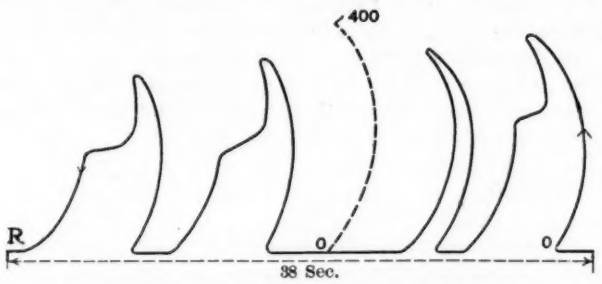


FIG. 4.—CURVES FOR ELEVATOR MOTORS.

of a heavy pendulum arranged to make contact with a drop of mercury at the middle of its swing, and of such length as to give the desired time interval.

Records of speed are taken in the same manner as those of voltage. A Remy magneto dynamo is geared or belted to the machine whose speed is to be recorded, and is connected to the low-voltage binding posts of the recording voltmeter, with such resistance in the circuit as will enable the speeds to be obtained from the voltmeter readings by using a simple reduction factor. Both the line-voltage and the speed may be taken with the same voltmeter by the use of a suitable double-throw switch.

The chronograph shown in Fig. 1 gives eighteen inches of record per revolution. A speed of one revolution per minute has proved very satisfactory for measuring the accelerating current of street-car motors, electric elevators and the like. One to three inches of record paper per minute will be found very satisfactory for continuous electric car tests.

The curves shown in Fig. 4 were taken on the machine shown in Fig. 1. The records were made on large size letter paper held on the cylinder by three or four rubber bands. They were taken from a test made in 1900 on the storage-battery and electric-elevators in the Hennepin County Court House in Minneapolis. The different curves indicate the runs between consecutive floors, except in the second curve at the right where the operator missed a floor, making it necessary to start up again.

The average value of any curve may be found by measuring the area of the curve with a planimeter and dividing this area by the length of the base line of the curve. This will give the height of a rectangle, having the same area and base line as the curve to be averaged. This height is the chord of the average reading as found by laying the chord on the scale arc with one end at zero.

The following statements concerning the accuracy of the records apply particularly to cases in which the recorder is used with Weston instruments. The stream of sparks, if continuous, has no effect on the reading of the instrument. The sparks do not always take the shortest path into the record paper. Drafts of air, caused to some extent by the heat of the sparks, and the air currents in the room, cause the sparks to jump about. This, however, introduces little difficulty, as the curve simply becomes wider and the middle points may be taken to obtain the true record. Drafts of air of sufficient strength to deflect the pointers may be guarded against by the use of a screen. The rectifier described below if used with the instrument need not introduce any perceptible error. The lag of the pointer will introduce no great errors with speeds of from one to twenty inches per minute. The lag must, however, be considered

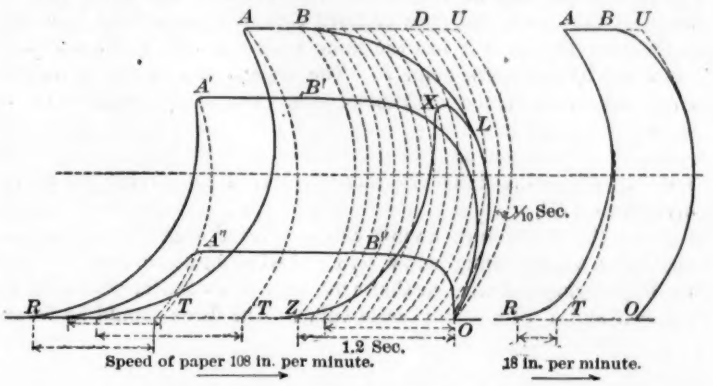


FIG. 5.—SPEED CURVES.

in interpreting high-speed records of transient currents, voltages, etc. In any case each instrument should be tested for pointed lag and curve distortion before attempting to interpret records. This may be done as follows:

Connect the apparatus shown in Fig. 1 in series with a storage battery and a non-inductive resistance and make records by suddenly switching the current on and off with the recording cylinder standing still, running at the normal speed and also at a very high speed, as shown in Fig. 5. A similar test should be made on the voltmeter. The time and position lag and the curve distortion can then be easily determined. The corrections in curve shape in slow changes in current and voltage may be neglected, since the acceleration of the moving parts of the instrument, in such cases, takes place over a long time and hence is small, or in other words

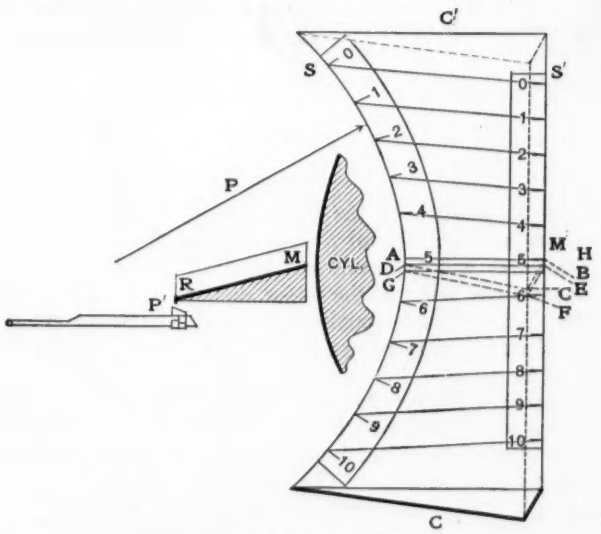


FIG. 6.—DETAILS OF SCALE RECTIFIER.

the difference between the controlling or spring force, and the actuating force is small and hence the traced curve and the true curve coincide.

Curve distortion is due to pointer lag and to the fact that the pointer has a component of mition with or against that of the record paper. Pointer lag will be found least in instruments, which are just aperiodic, and whose moving parts have small inertia, air resistance and friction, and powerful actuating and controlling forces.

By interposing the device described below, the curve form may be modified to advantage in some cases. The records of the readings of any instrument, whether of uniform or non-uniform scale divisions may be rectified, i. e., made with straight ordinates, with scale divisions of uniform length. Also, the readings may be re-

corded as any power, root, multiple, or sub-multiple of the readings of the instrument. For example, the record may take the squared values of the instantaneous currents, enabling the average heating effects of a varying current to be obtained. This applies particularly to railway motor tests. Further, in case it is desirable to make records of several instruments on a narrow strip, all readings may be reduced in size, or in cases of only one record, the scale length may be increased.

The rectifier may be very easily constructed as follows: Make a block of dry wood, red fibre or hard rubber, substantially as shown in Fig. 6. The scale S has the same scale divisions and arc as that described by the spark point P. The scale S can be traced directly from the scale of the instrument and then pasted in position as shown.

Scale S' is made any length desired and divided into uniform spaces. These divisions are then numbered to correspond to the divisions on S.

Wind the block with double cotton-covered magnet wire of size about No. 28, beginning below zero and winding above the maximum reading, laying the wire so that each turn will connect points on the scales S and S' of the same scale value. The turns should be wound

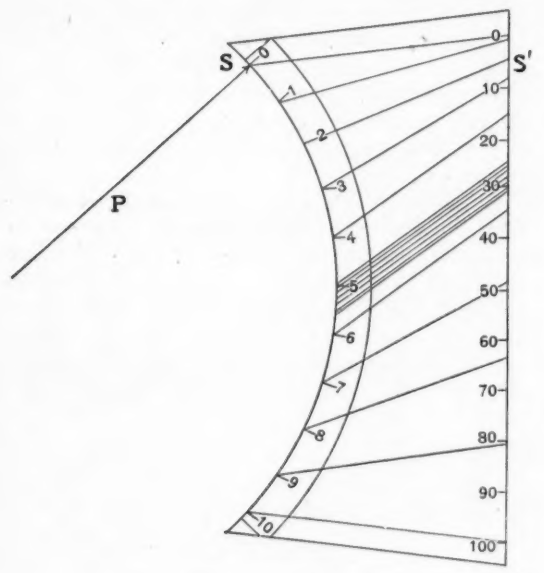


FIG. 7.—RECTIFIER FOR RECORDING SQUARED VALUES.

as closely as possible on the shorter scale. Thoroughly cover the top surface and the edge of S with several coats of thin shellac so that the wires will be firmly cemented to the block. Cut all the wires across the block on the under side, as at C' C and pull them straight out at M, and straight down at R. Carefully cut these off close to the block with shears or with a carpenter's chisel, as shown at M and R.

The sparks will pass from the pointer P through the wire R M nearest the pointer and into the recording cylinder as shown in Fig. 6.

Fig. 7 shows the method of winding to obtain squared values of instantaneous readings. The same general method would also apply to other powers, or multiples of the instrument readings.

Uranium a Radioactive Parent.

Recent researches of Rutherford and Soddy appear to demonstrate that uranium is the parent, mediate or immediate, of radium. Polonium descends from radium in the seventh generation, the intermediate links being emanations and other unstable products. Polonium finally becomes either bismuth or lead, and then remains in that condition for a period beyond human computation. The transformation of radium into lead takes some 40,000 years. Our English contemporary, the *Electrician,* in commenting on this, says that we may take it that our gold standard is safe for that period at least, unless somebody succeeds in controlling the transmutation by artificial means. But no agency hitherto discovered seems to affect the process of disintegration to the smallest extent.

Regulation and Efficiency of Transmission Lines.

By Harold Pender, Ph.D.

THE method usually employed in calculating the regulation and efficiency of transmission lines involves the use of a certain constant, which constant depends upon the size and distance apart of the several wires forming the transmission circuit, the frequency of the current, and the power factor of the load at the receiving end. A table giving the values of this constant for various size wires and frequencies was prepared several years ago by one of the large electrical manufacturing companies, and has been reprinted in numerous electrical engineering handbooks. The writer desires to call attention to a very considerable error in this table.

The table in question may be found on page 126 of Foster's "Electrical Engineer's Pocket Book," and the explanation of its use on pages 124 and 125. The constant is there designated by the letter M, and appears in the following formula (page 124):

$$\textit{Volts loss in line} = \frac{P \times E \times M}{100}. \qquad (1)$$

where P is per cent. of delivered power lost in transmission, and E is the potential difference between wires at receiving end.

From the above equation it is seen that M has a simple physical meaning, namely, it is the ratio of the per cent. volts lost in transmission to the per cent. power lost in transmission, expressed in terms of delivered volts and of delivered power.

An approximate formula for this quantity can be readily obtained. The formula derived will be shown to be correct to within less than 2 per cent. for any case likely to arise in practice.

Let n = the number of phases.
V = potential difference between adjacent wires at generating end.
E = potential difference between adjacent wires at receiving end.
W = watts delivered at receiving end.
I = current per wire.
r = resistance of each wire per unit length.
x = reactance of each wire per unit length.
L = length of each wire.
$\cos \alpha$ = power factor of load at receiving end.
P = per cent. power lost in transmission, in terms of delivered power.
Q = per cent. volts lost in transmission, in terms of delivered volts.

$$M = \frac{Q}{P}.$$

Draw $C\,G$ and $D\,B$ perpendicular to $O\,A$ produced.

Volts loss:

$$\frac{Q\,E}{100} = V - E. \qquad (2)$$

To a close approximation in any practical case,

$$V - E = A\,B \text{ (see diagram).} \qquad (3)$$

But $$A\,B = A\,C\,\cos\alpha + C\,D\,\sin\alpha. \qquad (4)$$

Now $$A\,C = 2\sin\frac{\pi}{n}\,I\,.\,r\,.\,L = \text{resistance drop per phase,} \qquad (5)$$

$$C\,D = 2\sin\frac{\pi}{n}\,I\,.\,x\,.\,L = \text{reactance drop per phase,} \qquad (6)$$

and $$I = \frac{2\,W\sin\frac{\pi}{n}}{n\,E\cos\alpha} \qquad (7)$$

Hence, $$A\,B = \frac{4\,W\,L\sin^2\frac{\pi}{n}}{n\,E}\,(r + x\tan\alpha), \qquad (8)$$

and therefore

$$Q = 100\,\frac{4\,W\,L\sin^2\frac{\pi}{n}}{n\,E^2}\,(r + x\tan\alpha). \qquad (9)$$

Power loss:

$$\frac{P\ W}{100} = n\ .\ I^2\ .\ r\ .\ L. \qquad (10)$$

Substituting the value of I from (7),

$$P = 100\ \frac{4\ W\ L\ r\ \sin^2 \frac{\pi}{n}}{n\ E^2\ \cos^2 a}. \qquad (11)$$

From (9) and (11) we then have

$$M = \left(1 + \frac{x}{r}\ \tan a\right) \cos^2 a. \qquad (12)$$

Using this formula, the writer has computed the accompanying table, giving the values of M for all sizes of wire from No. 0000 to No. 10 B. & S. for power factors of 95, 90, 85 and 80 per cent., and for frequencies of 25, 40, 60 and 125 cycles per second, for a distance between wires of 18 in. For unity power factor $M = 1$. The values of M calculated for wires 18 in. apart can also be used for other distances met with in practice without the introduction of considerable error.

Values of $M = \left(1 + \frac{x}{r}\ \tan a\right) \cos^2 a$.

No. of wire B. & S. gauge.	Area of wire in 1000 C.M.	Reactance, 100 v. 1000 ft. 25° C.	Reactance, 100 ~ per 1000 ft. 18" between wires.	25 cycles. Per cent. Power Factor.				40 cycles. Per cent. Power Factor.				60 cycles. Per cent. Power Factor.				125 cycles. Per cent. Power Factor.			
				95	90	85	80	95	90	85	80	95	90	85	80	95	90	85	80
0000	212	.0499	.176	1.17	1.16	1.12	1.06	1.32	1.36	1.36	1.32	1.53	1.64	1.67	1.66	2.21	2.54	2.72	2.76
000	168	.0628	.181	1.12	1.09	1.05	.99	1.24	1.26	1.24	1.19	1.41	1.49	1.50	1.47	1.97	2.22	2.34	2.37
00	133	.0794	.186	1.08	1.04	.99	.92	1.18	1.18	1.14	1.09	1.32	1.36	1.35	1.31	1.77	1.96	2.04	2.04
0	106	.0997	.190	1.05	1.00	.94	.87	1.13	1.11	1.06	1.01	1.24	1.26	1.24	1.19	1.61	1.74	1.80	1.79
1	83.5	.126	.194	1.02	.96	.90	.83	1.09	1.05	1.00	.94	1.18	1.17	1.14	1.08	1.47	1.57	1.59	1.56
2	66.6	.159	.198	1.00	.93	.86	.79	1.05	1.01	.95	.88	1.12	1.10	1.06	1.00	1.37	1.42	1.42	1.39
3	52.4	.202	.202	.98	.91	.84	.76	1.02	.97	.90	.83	1.08	1.05	.99	.93	1.27	1.30	1.28	1.24
4	41.6	.254	.206	.96	.89	.81	.74	1.00	.94	.86	.80	1.05	1.00	.94	.87	1.20	1.21	1.18	1.13
5	33.1	.319	.211	.95	.88	.80	.72	.98	.92	.84	.77	1.02	.97	.90	.83	1.15	1.13	1.09	1.03
6	26.2	.403	.215	.94	.86	.78	.70	.97	.90	.82	.74	1.00	.94	.87	.79	1.10	1.07	1.02	.96
7	20.7	.510	.219	.94	.85	.77	.69	.95	.88	.80	.72	.98	.91	.84	.76	1.06	1.02	.96	.90
8	16.6	.635	.224	.93	.85	.76	.68	.94	.87	.79	.71	.97	.89	.82	.74	1.03	.98	.92	.85
9	13.0	.813	.229	.92	.84	.76	.67	.94	.86	.77	.69	.95	.88	.80	.72	1.01	.95	.88	.81
10	10.4	1.01	.234	.92	.83	.75	.67	.93	.85	.76	.68	.94	.86	.79	.71	.99	.92	.85	.78

A comparison of this table with that given on page 126 in Foster's "Pocket Book" will make evident that the latter table has presumably been based upon an incorrect theory, for the error in it is anywhere from 5 to 50 per cent.

To determine to what extent the above formula is in error, due

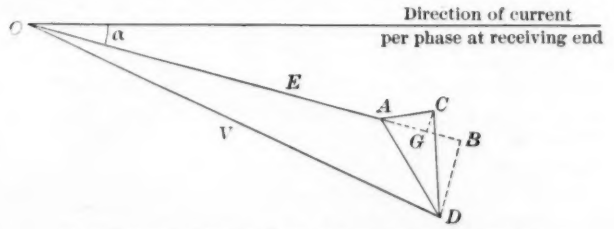


DIAGRAM OF COMPONENT ELECTROMOTIVE FORCES.

to the assumption that $V - E = A\ B$ (see diagram), an accurate determination may be made as follows:

From the diagram,

$$V^2 = (E\ \cos a + A\ C)^2 + (E\ \sin a + C\ D)^2; \qquad (13)$$

substituting the values of $A\ C$ and $C\ D$ from equations (5), (6) and (7), and regrouping terms,

$$V^2 = E^2 + 2\ W\ L\ (r + x\ \tan a) + \frac{1}{E^2}\left(\frac{W\ L\ z}{\cos a}\right)^2. \qquad (14)$$

Whence,

$$V - E = \sqrt{E^2 + 2\ W\ L\ (r + x\ \tan a) + \frac{1}{E^2}\left(\frac{W\ L\ z}{\cos a}\right)} - E. \qquad (15)$$

This formula can hardly be said to possess the simplicity of the expression for the volts lost in terms of M, formula (1).

The two following special cases, in each of which is assumed a 10 per cent. volt loss in transmission, will serve to show that even for extreme conditions of power factor, size of wire and frequency, the formula above deduced for M is sufficiently accurate for all practical purposes. The errors that would result from the use of the old values of M are also given. These latter are so great that, for the conditions chosen, the old table of M is absolutely worthless.

Case 1.

3-phase system.
25 cycles.
No. 10 wires, 18 in. between centers.
10,000 volts at receiving end.
500 kw. delivered.
80 per cent. power factor.
36.1 amp. per wire.
3.5 miles, length of line.
5.35 resistance of each wire per mile, at 25° C.
.308 reactance " " " "
5.36 impedance " " " "

Exact solution:

$$V - E = \sqrt{E^2 + 2\ W\ L\ (r + x\ \tan a) + \frac{1}{E^2}\left(\frac{W\ L\ z}{\cos a}\right)^2} - E = 992.$$

Power loss in line $= 3\ R\ I^2 = 72.9$ kw.
Per cent. power loss in line $= 14.58$.

Approximate solution, old value of M:

$$V - E = \frac{P \times E \times M}{100} = 1{,}458.$$

Per cent. error $= 47$.

Approximate solution, new value of M:

$$V - E = \frac{P \times E \times M}{100} = 977.$$

Per cent. error $= 1.51$.

Case 2.

3-phase system.
125 cycles.
No. 0000 wires, 18 in. between centers.
10,000 volts at receiving end.
2,000 kw delivered.
80 per cent. power factor.
144.4 amp. per wire.
4.4 miles, length of line.
.263 resistance of each wire per mile, at 25° C.
1.16 reactance of each wire " "
1.19 impedance of each wire " "

Exact solution:

$$V - E = 1{,}029.$$

Power loss in line $= 72.6$ kw.
Per cent. loss in line $= 3.63$.

Approximate solution, old value of M:

$$V - E = 1{,}268.$$

Per cent. error $= 23.2$.

Approximate solution, new value of M:

$$V - E = 1{,}002.$$

Per cent. error $= 2.6$.

On a Method of Potential Regulation Based on the Different Resistance Behavior of Carbon and Tantalum Lamps.

BY A. E. KENNELLY AND S. E. WHITING.

THE marked difference between behavior of carbon and tantalum incandescent lamps at different voltages has suggested to us the possibility of employing this property for the operation of a relay capable of controlling, by its secondary actions, the voltage of a circuit.

It is well known that the resistance of a carbon filament incandescent lamp falls very markedly as the current through it increases. Thus, a 120-volt, 16-cp carbon lamp, which has a resistance of 600 ohms when cold, will have a resistance of about 300 ohms when at normal incandescent voltage. A 110-volt tantalum lamp, on the other hand,* which has a resistance of 50 ohms when cold, may have a resistance of 300 ohms when at normal incandescent voltage. In each case the most rapid change of resistance takes place in the initial stages of voltage and current application. Between half voltage and full voltage, the changes in resistance are relatively small. If, therefore, a Wheatstone bridge arrangement, *A B C D*, Fig. 1, be made up between a pair of mains, *M M*, with two branches, *r, r*, of similar resistance, the branch *B C*, with carbon filament incandescent lamps, and the branch *D C*, with tantalum filament incandescent lamps, a polarized relay or equivalent magnetic mechanism, *R*, can be made to respond to variations in the line voltage between the mains *M M*. All of the incandescent lamps will be operated at much below their normal voltage, and the resistance of the lamps will, therefore, be in a state sensitive to changes of voltage. If, for instance, a bridge balance is secured at a voltage $e = 115$ volts, then if the voltage should rise, say, to 116, the carbon filament branch of the bridge will diminish in resistance, while the tantalum filament branch will increase in resistance. This dissymmetry will destroy the balance and send a current through the relay from *D* to *B*, tending to throw the tongue of the relay against the contact stop, *c*. If, on the contrary, the main voltage should fall, the carbon resistance would increase and the tantalum resistance decrease, upsetting the balance in the opposite sense and sending a current through the relay from *B* to *D*. This current would tend to throw the tongue of the relay against the contact stop, *b*. Under these conditions the relay would be capable of operating apparatus through its local circuits in some of the various known ways for regulating the main voltage.

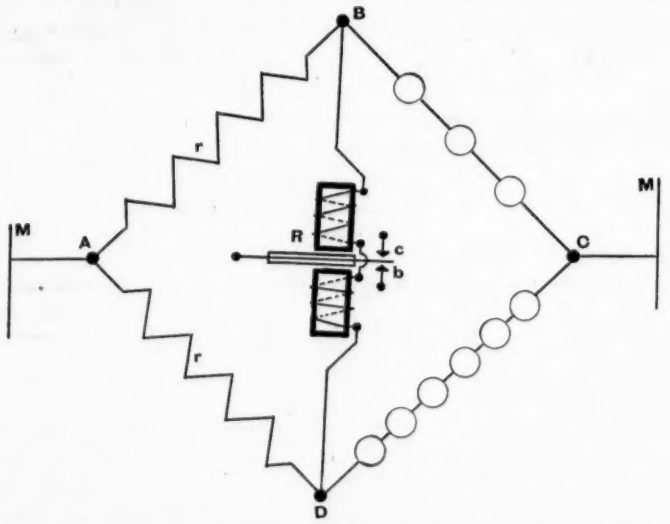


FIG. 1.—WHEATSTONE BRIDGE SENSITIVE TO VARIATIONS IN E.M.F.

The bridge connections of Fig. 1 are naturally capable of being modified in a variety of ways in order to attain the same result. Thus, either the carbon lamps or the tantalum lamps may be removed and replaced by an invariable resistance of metallic wire. This plan should be less sensitive, since the bridge would possess but a single resistance-varying arm. Again, all four arms of the bridge might be made of variable resistance, both *A D* and *B C* being occupied by carbon lamps, while both *A B* and *C D* would be occupied by tantalum lamps. This plan should be a more sensitive arrangement.

An alternative plan to the use of the Wheatstone bridge is offered by the use of a differentially wound polarized relay, as indicated in Fig. 2. *R* is a differential polarized relay. The circuit from the mains, *M M*, splits through the coils of this relay, passing on one side through the carbon filament lamps, *C C C*, and on the other side through the tantalum filament lamps, *T T T*. The lamps are so

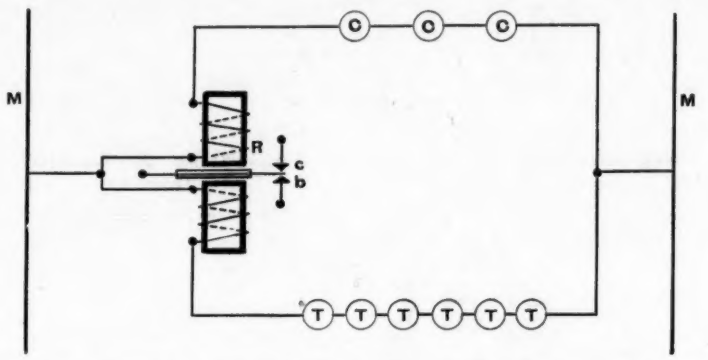


FIG. 2.—DIFFERENTIAL RELAY SYSTEM SENSITIVE TO VARIATIONS OF E.M.F.

chosen, or the resistances of their respective paths so adjusted, that the two branch currents have equal strength at normal voltage between the mains, thus leaving the relay in balanced condition, i. e., with zero excitation. If now the main voltage should rise, the resistance of the carbon branch will diminish and that of the tantalum branch will increase, thereby upsetting the balance in favor of the carbon branch current, and urging the tongue of the relay against the stop, *c*. On the contrary, if the main voltage should fall, the differential balance would be upset in the opposite direction and the tongue of the relay urged against the opposite stop. This action of the relay might likewise be invoked to control the main voltage through mechanism actuated by local circuits from the relay.

In order to test the arrangement of Fig. 2, the authors employed a differential Western Union polarized relay, such as is used in the polar duplex system. The resistance of each of the two relay coils was approximately 423 ohms at the working temperature. The armature of the relay was a steel tube 0.379 in. (0.963 cm.) in diameter. The play of the tongue between the stops was 0.0015 in. (0.038 mm.) and the clearance or air-gap between the armature tube and the poles was 0.06 in. (1.5 mm.) on each side. Three carbon filament, 120-volt, 16-cp lamps were employed on one side at *C C C*, and six 110-volt, 25-hefner, tantalum filament lamps were employed on the other side at *T T T*. This arrangement secured a current strength of 84 milliamperes in each branch, or a differential balance, at the main voltage of 120.4 volts. The drop in each relay coil being 35.5 volts, the remainder, or 84.9 volts, was impressed upon each set of lamps, representing 28.3 volts per lamp in the carbon series, and 14.15 volts per lamp in the tantalum series. Under these conditions, the resistance offered by each carbon lamp averaged 336 ohms, and that offered by each tantalum lamp 168 ohms.

It was found that, under laboratory conditions, when the relay was carefully adjusted, an increase in main voltage of 0.6 volt (120.4 to 121 volts) would cause the relay to throw over its tongue in one direction, and a fall of 0.6 volt, or back again to 120.4 volts, would cause the relay to throw its tongue back against the original stop. Consequently the relay was found to be capable of operating continuously on a voltage variation of ½ of 1 per cent. The movement of the relay followed the change in voltage after a time lag of about one second. This time lag appeared to be of thermal origin and to be attributable to the action of the lamps.

It seems likely that with a relay specially designed for this work, a still greater degree of sensitiveness could be obtained.

The following is an outline of the engineering theory of the apparatus of Fig. 2:

Let e = the normal e.m.f. between the mains *M M* (volts).
r = the resistance of each relay coil (ohms).
r_c = the total resistance in the carbon lamps at normal balance (ohms).
r_t = the total resistance in the tantalum lamps at normal balance (ohms).
i_c = the current in the carbon lamps (amperes).
i_t = the current in the tantalum lamps (amperes).

*"Some Tests of Tantalum Lamps," by A. E. Kennelly and S. E. Whiting, ELECTRICAL WORLD AND ENGINEER, March 25, 1905.

R = the total resistance in each branch (ohms).
Then $R = r + r_c = r + r_t$ (at balance),
$i_c = i_t = i$ (at balance).
Then $e = i_c (r + r_c) = i_t (r + r_t)$.
When the balance is upset, let the differential current, $i_c \sim i_t = di$.
Then

$$\left(\frac{\frac{di}{i}}{\frac{de}{e}}\right) = \frac{1}{1 + a i \left(\frac{\frac{dr_c}{di_c}}{r_c}\right)} - \frac{1}{1 + a i \left(\frac{\frac{dr_t}{di_t}}{r_t}\right)} \qquad (1)$$

where $a = \frac{r_c}{R} = \frac{r_t}{R}$.

This expression $\left(\frac{\frac{di}{i}}{\frac{de}{e}}\right)$ is the ratio between the differential current expressed as a fraction of the normal branch current and the change of voltage producing the disturbance (expressed as a fraction of the normal voltage). This ratio may be called the ratio of sensitiveness, since the more sensitive the arrangement of variable resistances, the greater will be this fraction. Under the conditions of the above-mentioned test, $r = 423$, $R = 1{,}431$, $a = 0.704$, $\frac{de}{e} = 0.005$, $i = 0.084$, the sensitiveness ratio was 0.38; so that for a change of voltage of 1 per cent, the differential current was upset by 0.38 per cent of the normal current (84 milliamperes); or 0.319 milliamperes, or for ½ of 1 per cent (0.6 volt) 0.16 milliampere. This agrees with direct measurement of the sensitiveness of the relay, which operated under the same adjustment with less than 0.2 milliampere.

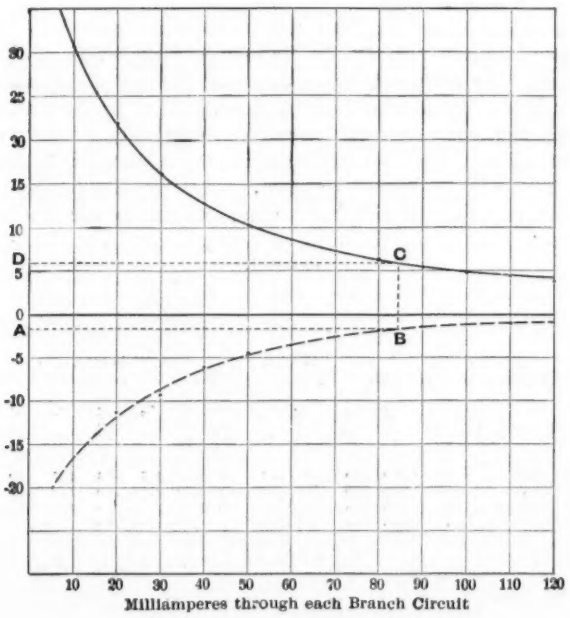


FIG. 3.—CURVES GIVING VALUES OF $\left(\frac{\frac{dr_t}{di}}{r_t}\right)$ AND $\left(\frac{\frac{dr_c}{di}}{r_c}\right)$ FOR THE LAMPS EMPLOYED IN THE TEST.

A first approximation to the equation (1) is given by the formula

$$\frac{\frac{di}{i}}{\frac{de}{e}} = a i \left\{ \left(\frac{\frac{dr_t}{di_t}}{r_t}\right) - \left(\frac{\frac{dr_c}{di_c}}{r_c}\right) \right\} \qquad (2)$$

In this formula $\left(\frac{\frac{dr_t}{di_t}}{r_t}\right)$ is the proportional change in the tantalum resistance per ampere increase of current and $\left(\frac{\frac{dr_c}{di_c}}{r_c}\right)$ the corresponding proportional change of resistance per ampere for carbon. Fig. 3 gives the plot of these values from experimental observations on the lamps employed. The upper curve through C gives the value for the tantalum resistance and the lower or dotted curve through B that for the carbon resistance. Thus at 0.084 ampere, the value of this proportion is 6 for tantalum and —1.8 for carbon. That is the tantalum resistance, if it is kept on steadily rising in resistance for one ampere increase of current as fast as it does by observation for a very small increase of current, would add 600 per cent to its resistance. The length of the line $C B$ gives the value of the quantity within the large bracket in formula (2) and the area of the rectangle $A B C D$ gives the value

$$i \left\{ \left(\frac{\frac{dr_t}{di_t}}{r_t}\right) - \left(\frac{\frac{dr_c}{di_c}}{r_c}\right) \right\}$$

so that it is desirable to employ such a balance in the branch circuits as will permit the area $A B C D$ enclosed between the current strength and the distance between the two curves to be a maximum. There is comparatively little difference between the areas thus enclosed, between the limits of current 25 milliamperes and 100 milliamperes, so that the sensibility ratio did not vary markedly between these limits.

It seems possible that iron wire filaments worked near the temperature of recalescence, like the ballast resistance of Nernst lamps, might be even more sensitive in resistance to current variations than tantalum, and might produce a still more sensitive regulator.

We are indebted to Messrs. T. F. Clark and M. C. Harrington, of the Western Union Co. for their courteous assistance in enabling us to secure the differential relay for the test.

A Method of Calculating the Core-Loss in Large Alternators.

BY T. S. ALLEN.

IN large fly-wheel engine type generators where it is impossible to accurately measure the core-loss and on which the manufacturer is compelled to guarantee rather high efficiencies, the necessity for a fairly accurate method of calculating core-loss is quite evident. With this point in view, the writer will endeavor to make clear a method of calculation which has been adopted by the Electrical Department of the Allis-Chalmers Company and which, in general, gives very satisfactory results.

The fact that it is impossible to accurately figure the core-loss in a generator means that it is also impossible to accurately figure the efficiency, but with the help of average results on previous machines and the careful measurements of losses in the iron used, a fairly close approximation to the core-loss may be attained, as shown by the following data which were taken on a number of 25-cycle and 60-cycle Bullock type alternators.

We will take for example the calculation of the core-loss in a small engine type generator, 200 k.w., 4,400 volts, 120 r.p.m., 3-phase, 60-cycles. It is first necessary to measure as accurately as possible the hysteresis and eddy-current loss in the iron used. This was done by taking from the finished armature punchings small transformer punchings 1½ inches wide by 5½ inches long, which were punched out with a special die. The method of selecting the iron for these punchings is as follows: The armature punchings were gone over while in stacks and a transformer punching taken out of every half inch of iron, thus giving a quantity of transformer iron containing practically the same characteristics as that in the armature. From these punchings a small transformer core was built up, outside dimensions 7 in. by 7 in., inside dimensions 4 in. by 4 in., and compressed to a depth of 3 in., thereby securing practically the same amount of iron per inch as in the armature. This core was

carefully weighed and the section calculated from the weight was checked against the section calculated from the dimensions. On this core was wound a coil of 200 turns. In measuring the losses in this transformer core, the terminals of the coil were connected through a wattmeter to an alternating-current, 60-cycle circuit with a voltmeter across the line. By varying the volts supplied, a set of volt and watt readings was obtained from which it was possible to calculate the watts per pound at different densities. The results of this test are shown by the curve *A*, Fig. 1.

The core loss of the generator was very carefully measured in the following manner: A direct-current motor was belted to the rotor of the generator, which was driven at normal speed, and the input at the motor measured with and without the fields of the generator excited; the difference between these readings after the losses of the driving motor were subtracted, gave the core loss of the generator for that particular field excitation. By varying the field strength of the generator and taking readings of volts at generator terminals and input at motor terminals, a series of readings was obtained which were plotted in the form of a curve, as shown in Fig. 2. From this curve it is seen that the core loss at normal voltage 4,400 is 3½ kw.

From the average densities in the armature core and teeth at a voltage of 4,400, and the weight of steel in armature and teeth, it was possible to figure the core loss from the curve marked *A*, Fig. 1. At 4,400 volts, the density in the armature core is 30,000 lines per square inch, which corresponds to a loss of 2.4 watts per pound. The weight of iron in the armature core is 1,250 pounds, thus giving a loss in the core of .3 kw. The density in the teeth was obtained by taking the mean ordinate of that area subtended by the permeability curve between the densities in tooth roots and tips; in other words, this density is the average between the tooth root and tooth dip densities, taking into consideration the shape of the permeability curve between these two points; the average tooth density in this case was 95,000 lines per square inch, which corresponds to a loss of 2.2 watts per pound from curve *A*; the weight of iron in the armature teeth is 430 pounds, which gives a loss in the teeth of .95 kw. The total loss in core and teeth is 1¼ kw. Therefore, it is found that the actual measured core loss is 2.8 times greater than that calculated in this particular machine.

With the weight of iron in the armature core and teeth, and the corresponding core loss as calculated from curve *A*, it is possible to divide the measured core loss into two parts, one corresponding to the tooth loss, and one to the loss in the core. From these values, the watts per pound at the corresponding densities were figured, giving two points, one for the armature density and one for the tooth density. The values were figured for four different voltages

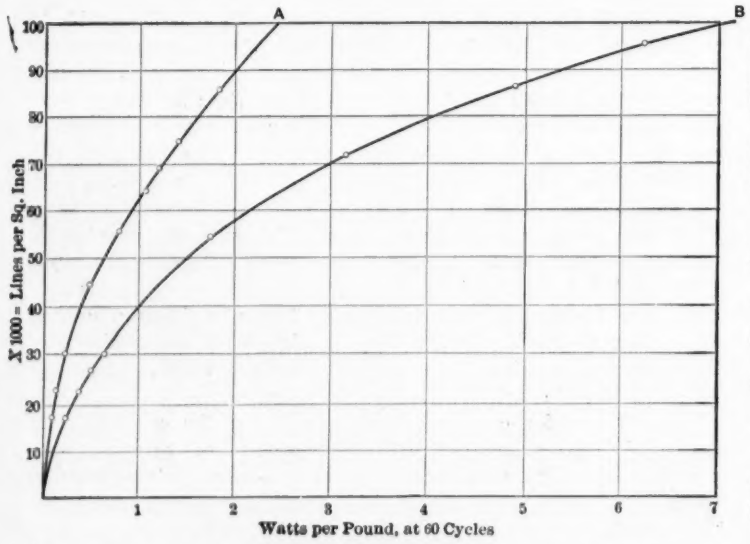


FIG. 1.—HYSTERESIS AND EDDY-CURRENT LOSSES. A: FROM TRANSFORMER TEST. B: FROM CORE-LOSS TEST.

(see Table I), thereby giving eight points which were plotted in the form of a curve (see curve marked *B*, Fig. 1).

A glance at the two curves in Fig. 1 will show at once the wide variation between the actual measured core loss and the core loss calculated from the transformer test.

Table II gives the results on eleven different 60-cycle machines worked up in the same manner as the preceding example. In the column marked "K" will be found the number by which the transformer core loss should be multiplied to obtain the actual core loss. The average K was found to be 2.906, or nearly 3. The variation is from 2.2 to 3.82. At first this variation may seem rather large, but on considering the number of variables upon which K depends, the reader will at once realize that very good results were obtained because, in order to have the same K in any two generators, it would be necessary to have the same pressure between armature

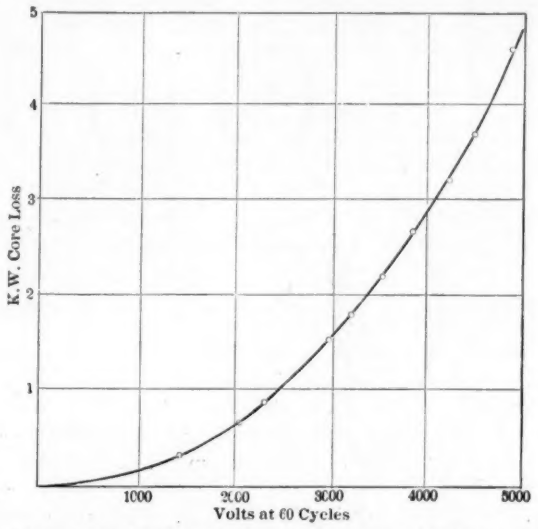


FIG. 2.—CORE LOSS CURVE, 200-KW, 4400-VOLT, 200-R.P.M., 3-PHASE, 60-CYCLE GENERATOR.

punchings and the same amount of japan between punchings; in other words, the two armatures would have to be built up identically the same, and the same degree of accuracy would have to be maintained in the tests on both.

The wide difference between the transformer core loss and the actual core loss is largely due to the uneven distribution of the magnetic flux in the armature core and teeth, causing abnormally high densities in some sections and low densities in others; and, as the hysteresis and eddy-current losses are practically proportional to the square of the density, it will be seen that in parts of the magnetic circuit there will be very high losses. As it is impossible to calculate the variation in density, we are forced to use the average

TABLE I.

Volts at terminals of generator.	Densities—Arm. Core.	Densities—Arm. Teeth.	Weight, lbs.—Core.	Weight, lbs.—Teeth.	From test—Watts, per lb.—Core.	From test—Watts, per lb.—Teeth.	From test—K.W. loss.—Core.	From test—K.W. loss.—Teeth.	From test—K.W. loss.—Total.	From t'sformer curve.—Watts, per lb.—Core.	From t'sformer curve.—Watts, per lb.—Teeth.	From t'sformer curve.—K.W. loss.—Core.	From t'sformer curve.—K.W. loss.—Teeth.	From t'sformer curve.—K.W. loss.—Total.
4400	30,000	95,000	1250	430	.67	6.2	.84	2.66	3.5	.24	2.2	.30	.95	1.25
4000	27,000	86,000	1250	430	.51	4.9	.64	2.11	2.75	.20	1.9	.25	.82	1.07
3300	22,200	71,000	1250	430	.40	3.13	.50	1.35	1.85	.16	1.27	.20	.54	.74
2500	17,000	54,000	1250	430	.25	1.72	.31	.74	1.05	.105	.72	.13	.31	.44

TABLE II.

Rating—K.W.	Volts.	R.P.M.	Phase.	Cycles.	Core loss K.W.—Measured.	From Transformer	K.
200	4400	120	3	60	3.5	1.25	2.8
1000	2300	200	3	60	16.	4.19	3.82
750	6600	120	3	60	19.	5.84	3.26
5500	2300	300	3	60	74.	33.6	2.2
500	2300	600	3	60	10.	3.67	2.72
450	2400	150	3	60	14.	5.6	2.5
1500	2500	1800	2	60	21.5	6.9	3.11
125	240	277	2	60	1.9	.55	3.46
150	2300	120	3	60	3.5	1.25	2.8
800	2300	90	2	60	13.5	4.75	2.85

TABLE III.

Rating—K.W.	Volts.	R.P.M.	Phase.	Cycles.	Core loss K.W.—Measured.	From Transformer	K.
800	375	125	3	25	9.7	3.67	2.64
800	480	125	3	25	10.5	3.87	2.74
750	2200	500	3	25	21.5	7.90	2.72
300	1100	167	2	25	4.0	1.63	2.45
1000	375	94	3	25	14.0	4.50	3.10
155	2300	500	3	25	2.8	1.053	2.65
950	2300	375	3	25	15.0	6.05	2.25

density which, of course, gives a much lower core loss. Another loss which is not taken into consideration in the transformer test is the hysteresis and eddy-current loss in the pole faces, although this loss would be very small in a well-designed machine.

From the above data it is evident that the core loss of a generator,

calculated from a transformer test on the iron used and at densities corresponding to normal voltage, gives in every case a value much lower than the actual. This value is found to be approximately one-third the actual value in 60-cycle generators.

In Table III are shown the results from seven 25-cycle generators. These data were taken in the same manner as those on the 60-cycle generators excepting the tests on the small transformers, which were made at 25 cycles. The average K in Table III is 2.65, which is slightly less than the average K from the 60-cycle machines, due to the smaller eddy-current loss at 25 cycles.

In conclusion, it may be quite interesting to compare the above method with the one used in calculating the core loss in the 5,000-kw generators installed in the Seventy-fourth Street (Manhattan) power station of the Interborough Rapid Transit Company, New York City, which was published in the *Electric Club Journal* of May, 1905. In this article it is stated that the losses in the generator were determined from a measurement of the losses in sample rings made from the material of which the armature was built up, the losses in the rings being measured at the working densities of the generators. It will be noticed that this method is practically the same as the one described above, which gave values about three-eighths as large as would be actually obtained in a core loss measurement on a 25-cycle generator. It would, therefore, appear from the above data that the Manhattan generators have a core loss somewhere in the neighborhood of 102½ kw instead of 38.69 kw, and an efficiency at full load of about 96.86 per cent instead of 98.39 per cent. Another point which would lead to the belief that the core loss as calculated was much too low is the fact that the rise in degrees centigrade on the armature iron was 13 per cent higher than the rise on any other part of the machine.

The Preservation of the Southern Appalachian Streams.

In his paper on this subject read at the recent Asheville A. I. E. E. meeting Mr. C. E. Waddell said that all large water-power developments in the South to-day are located on streams rising in the Appalachians, and therefore any influence that affects these rivers is of vital importance and far reaching in its consequences. A stream's value as a water power depends on the uniformity of its flow rather than on its quantity, and the regularity of flow is influenced by erosion of the hillsides and by floods.

The government gauging stations report an increasing irregularity in the streams of the Southern Appalachians, and investigations as to the cause leads to the conviction that it is on account of the removal of the forests. Originally these mountains were clothed t their summits with forests, but in the last few decades the lumbermen have made ruthless inroads, with deleterious consequences.

To form a clear conception of the nature of the influence of the forests it is necessary to consider the manner in which streams are formed and the methods by which they derive their supply. It must be noted that surface run-off is the cause of rapid fluctuations, while it is the perennial springs and underground drainage that furnish the permanent supply; therefore, regularity of flow is secured if run-off is diverted into storage. This is the part the forest performs. Its factors of conservation are the lower temperature, the shade, the capacity of the humus and the retarding of evaporation by protection from strong air currents.

Benefit is also derived from the mechanical action of the trees in breaking the fall of the raindrops, thereby protecting the soil, and to the obstruction offered by the roots to a rapid run-off of the precipitation. The roots further assist by increasing percolation through keeping the ground open and porous. The forest cover protects snowfall from rapid melting, and the snow in turn protects the earth from freezing, thereby keeping it open and susceptible to filtration when the snow does melt.

Evaporation is much more rapid from bare tracts than from wooded areas, and this is especially true of the mountains, as the greater the altitude the greater the effect in preventing evaporation.

In 1892 the first practical protection to forests in the United States was started on the Biltmore estate. The methods in vogue consist of mapping the tracts of timbered lands, making accurate suryeys of the extent and character of the forests, noting trees that have reached maturity, and reforesting bare tracts. Conservative methods of lumbering are pursued, the trees being removed in a manner that will not destroy the younger growths, and plantings of seedlings take the place of matured trees. On steep declivities where the forests have been previously removed, and where erosion has ensued, the hills are first staked in belts at regular intervals of some four feet, and artificial obstructions such as rhododendron and kalnia roots are introduced, which result in the formation of a new soil. After sufficient time has elapsed to insure permanency and a desired richness the hillsides are planted with very small trees of a kind especially adapted to the locality. The results of these methods are today apparent in the condition of the brooks and streams. The deposit of sediment is materially less on streams not so protected, and the streams are not so turbid after heavy rains.

The French Broad River, with its tributaries above Asheville, drains the Biltmore estate, and the fact that statistics show the French Broad to vary less than any other stream in the South Atlantic States may be attributed to the protection the river receives in the manner just outlined.

Recent Electrochemical Developments.

ELECTROLYTIC PROCESSES. CHLORIDE ELECTROLYSIS.

A recent patent granted to M. Couleru refers to the electrolytic manufacture of chlorates and perchlorates with a valuable product at the cathode. The chlorates and perchlorates are produced in the usual way at the anode by electrolysis of a chloride solution, while the alkali formed at the cathode is neutralized by means of chloride of lead to form lead peroxide. If chloride of manganese is used instead of lead chloride, peroxide of manganese is produced as a by-product.

M. Yasuda patents mechanical details of construction of the cathode in order to remove the hydroxide which is formed by electrolysis from the sphere of electrolytic action. He uses a case of insulating material with a passage in which the cathode is disposed and through which the electrolyte enters the case adjacent to the electrode. The bubbles of hydrogen which are developed simultaneously with the formation of the hydroxide rise from the cathode within the insulating casing and carry the hydroxide upward. The case is constructed in such a way that the partially decomposed electrolyte passes on and is retained within the case out of contact with the electrolyte which is not decomposed, and is repeatedly resubmitted to electrolytic action within the case until the desired degree of decomposition is obtained.

A patent granted to C. W. Roepper and W. E. Harmon refers to improvements in the mercury cathode process. The object is to facilitate the formation of the hydroxide solution from the amalgam. Te inventors employ an iron transferring-wheel for effecting circulation of the mercury. It is mounted in the

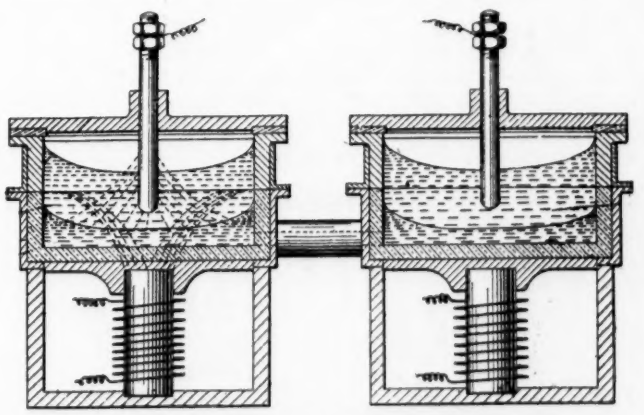


FIG. 1.—ASHCROFT METHOD OF PRODUCING CIRCULATION.

de-amalgamating compartment, dipping both below the water and amalgam. It is provided with buckets formed in the periphery and carrying the mercury.

The above three patents refer to electrolysis of aqueous solutions of chlorides. If fused salt is electrolyzed with a fused lead cathode as in the Acker process (the fused lead cathode in this case being quite analogous to the mercury cathode in the Castner Kellner process) E. A. Ashcroft proposes to produce the necessary circulation of the fused lead by the method shown in Fig. 1. The illustration shows two vessels and the object is to provide

for automatic circulation of the fused lead from one vessel to the other vessel through the connecting tube. For this purpose the vessels are constructed circularly, and one electrode in each vessel is suspended perpendicularly downwards from the top. The second electrode consists of the fused lead. Below the two vessels are placed the two cores of an electromagnet. The magnetic field produced by the electromagnet within the two vessels produces the required circulation, the necessary condition being that the lines of magnetic force cut the lines of electric current more or less at right angles and in a plane at right angles to the direction of the required motion. The magnetic lines of force and the electric lines of force are indicated by dotted lines in the left hand vessel of the figure.

ELECTROLYTIC DEPOSITION OF METALS.

Anson G. Betts, the indefatigable worker in the electrolytic refining of metals and best known by his lead refining process, has devised in recent years a complete scheme for treating electrolytic slimes. While his process is presumably applicable to the slimes of copper refiners, it was primarily devised in the interest of his lead process. It is well know that by his lead refining process Betts was able to produce a lead of excellent purity and quality, but in the meanwhile lead smelters had succeeded in producing by purely metallurgical processes lead of the same purity and at about the same cost. To make his electrolytic lead refining process superior to the metallurgical process, Betts had to devise a method of treatment of his slimes. Here he was placed before an entirely new problem and a very complicated and difficult one. If his method succeeds on a large scale, then the possibility of obtaining the considerable metallic values contained in the slimes will place his electrolytic process at an advantage over the metallurgical process, in which considerable losses are unavoidable. The complete scheme of Mr. Betts of treating the slime was described by him in an able article in the April issue of "Electrochemical and Metallurgical Industry." A patent has in the meanwhile been granted to him for one detail of the process, that is, the recovery of antimony from antimony trifluoride solutions.

Another patent recently granted to the same inventor refers to a process of extracting zinc from its ores. The zinc ore is roasted and lixiviated with sulphuric acid. The zinc sulphate solution is electrolized with a mercury cathode whereby the cathode becomes a zinc-mercury alloy, while the electrolyte is regenerated to sulphuric acid, suitable for further lixiviation. The mercury-zinc alloy is then used as anode in another cell with zinc chloride as electrolyte and zinc is deposted upon the cathode, while the amalgam is changed back into mercury, which is used again in the first cell above referred to.

F. A. Decker also precipitates zinc from a solution onto a cathode of mercury. A patent granted to him refers to details of the construction of the cathode. He uses a series of trays one above the other, containing mercury. In order to permit ready removal of mercury from the trays, each tray projects on either side through the walls of the vessel, while the opening is sealed by the mercury contained in the trays.

It has long been recognized that to get a good metallic deposit on the cathode with a high current density it is primarily necessary

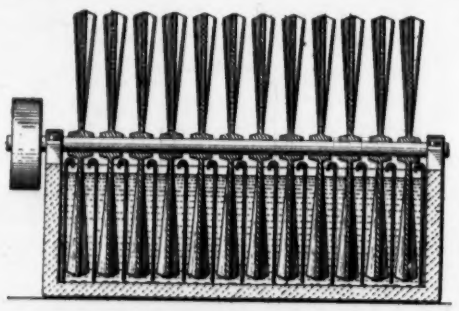


FIG. 2.—JOHNSON REVOLVING ANODE.

to prevent the electrolyte in proximity of the cathode from getting impoverished in the metallic ions to be deposited. For this purpose stirring and revolving electrodes have often been applied. H. C. Harrison and J. Day propose in a recent patent to use a highly polished cathode of circular cross-section, mounted vertically in the depositing vat and free to revolve about its own axis. To renew the layer of the electrolyte contiguous to the cathode they direct jets of electrolyte tangentially to the surface of the cathode.

W. McA. Johnson obtains the same result in a neat way by a revolving anode of propeller construction, as shown in Fig. 2.

Apparatus for electroplating purposes are described in two patents granted to C. D. Pratt and Louis Schulte, respectively. Pratt's apparatus is especially adapted for plating the insides of ferrules, rings, slip nipples, etc., while Schulte's apparatus is designed for plating sheet metal, band-iron and wire.

MISCELLANEOUS ELECTROLYTIC PROCESSES.

The difficulty in using electrolysis for the production of organic compounds is due mainly to the variety of possible compounds which may be formed and which when once formed participate in the conduction of the current and are again oxidized or reduced; special precautions must, therefore, be taken to get only the one product which is desired. C. Ellis makes tartaric acid and its salts or its isomers and their salts from saccharine matter (grape sugar) by electrolytic oxidation. The gradual oxidation produces various monobasic and dibasic acids. When it proceeds, up to the point where tartaric acid is formed, it becomes necessary to prevent its further oxidation. This is accomplished by the conversion of the tartaric acid into an insoluble or slightly soluble product. For this purpose potassium carbonate or potassium acetate are added.

W. Hoopes patents a process for manufacturing ammonia in a double-fluid cell with carbon electrodes. The cathode compartment contains ammonium sulphate and the anode compartment a solution of common salt. The temperature of the process is 100° C. Ammonia is developed at the cathode with free hydrogen, from which it may be separated by passing through water. Chlorine is developed at the anode.

A. S. Ramage patents a method of treating spent sulphuric acid pickle liquor to recover the metal and regenerate the liquor. The pickle liquor containing ferrous sulphate and free sulphuric acid is saturated with sulphuric dioxide and then conducted through electrolytic vats containing lead anodes and iron cathodes. Pure iron is deposited on the cathodes, while free sulphuric acid accumulates in the electrolyte.

A method of keeping different liquors separate from each other in an electrolytic vat by making use of centrifugal action is patented by R. V. Heuser. The anodes and cathodes are concentric and perforated and the whole vat is revolved. The liquid of higher specific gravity tends to go to the outside.

STORAGE BATTERIES.

A. Meygret patents a protective sheath or envelope for holding the active material firmly in place. The plate or grid when complete with the active material, is placed in a bath consisting of castor oil, pyroxylin and flexible collodion. The coating thus obtained is of an elastic nature and is then rendered porous to permit the electrolyte to pass into the active material.

C. H. Whiting patents mechanical details of construction of a storage battery plate in which a plurality of strips are united with an end piece; the strips having the receiving surface for the active material run parallel with the outer side faces of the end piece of the grid.

A patent granted to Mr. T. A. Edison refers to the construction of his gas separator, the function of which is to separate mechanically entrained globules of the electrolyte from the escaping gases.

D. P. Perry patents a relief valve for storage batteries which permits ready access to the interior of the battery and which also permits the generated gases to escape freely and without danger of spilling of the electrolyte and without danger of dust ordirt entering the battery.

A patent granted to R. Macrea refers to a storage battery with a container in form of two porous cups, one within the other. The inner cup is filled with active material and the outer cup between its inner wall and the walls of the inner cup with an electrolyte. The outer cup is covered upon its exterior surface with active material.

PRIMARY BATTERIES.

A recent patent granted to F. M. Holmes refers to the use of a battery solution which "comprises the combination, with a suitable acid exciting fluid of a gum soluble in water."

Various mechanical details of construction of primary batteries are covered in patents recently granted to D. L. Winters, B. J. Blameuser and three patents of W. C. Banks.

New Telephone Patents.

NEW TELEPHONE REPEATER.

Again an attempt has been made at the repeater problem, this time by Mr. H. E. Shreeve, of Newton, Mass., who has returned toward first principles and has combined the receiver and microphone button. The patent is assigned to the American Telephone & Telegraph Company, which thus appears to recognize the possibility of a solution to the repeater problem.

In early attempts at this type of repeater, either two diaphragms have been provided, one for each element, or a single diaphragm

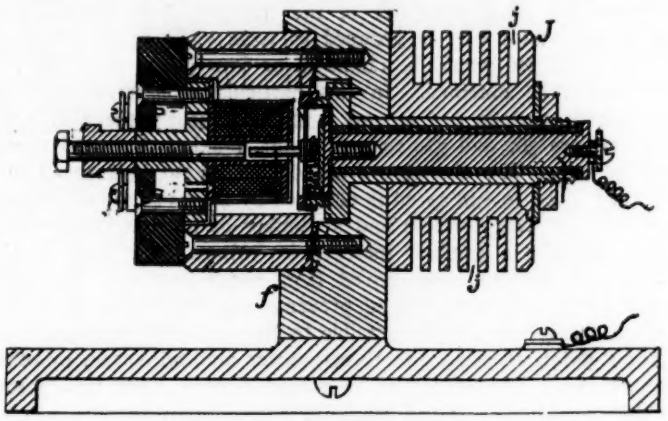


FIG. 1.—SHREEVE RELAY.

common to both has been used. Mr. Shreeve, however, entirely omits any diaphragm as such, and permits the field of the receiving part to act directly upon the moving parts of the sending portion. To this end, as shown in Fig. 1, a section of a repeater which it is claimed has operated, an armature *f* has been attached to the front electrode of a granular button of the solid back type, i. e., with mica auxiliary diaphragm. The moving parts are made very light and free of inertia, that the distortion may be reduced to a minimum. In the figure, two windings are shown upon the receiving part. One of these is a magnetizing coil which supplies the fundamental field of force upon which the voice current effects are superimposed.

Another feature of this repeater is the metallic mass *J*, provided with grooves, *j*, and serving as a radiator for the heat liberated in the transmitter.

Mr. Shreeve has obtained a second patent, also signed to the Bell Company, bearing upon the art of repeating. This describes an induction or repeating coil designed for use with a repeater in connection with composited circuits. This coil is based upon the peculiar magnetizing effects of rapidly varying currents.

If two opposing windings be distributed over different parts of the same core and subjected to slowly varying or steady currents, the magnetizing effects will largely neutralize each other. If, however, the currents be rapidly varying the effect of the opposing windings is almost unnoticeable. With such a coil, therefore, the Morse "thump," a rounded current impulse is of no effect, while voice currents are of full effect. By connecting a repeater to a composited line through such a coil, the "thump" does not magnify. It will be interesting to know how fully the claims for this repeating system are realized in actual working.

NEW TRANSMITTERS.

A new transmitter has been patented by Mr. J. F. Fletcher, of San Antonio, Tex., which has been especially designed so that it cannot

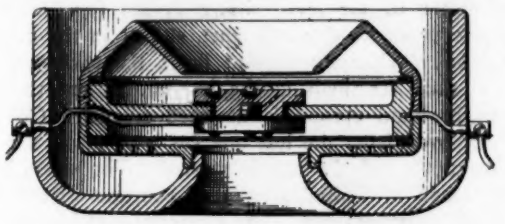


FIG. 2.—SNYDER TRANSMITTER.

be accidentally injured by one unacquainted with its structure. With this end in view all permanent connection between the concealed moving parts and the removable parts of the casing have been avoided, and contact between the diaphragm and the microphone electrodes is obtained through an adjustable pin. This is adjusted so that the tension of the diaphragm keeps it in contact with the electrode stem.

Fig. 2 shows another transmitter of the multiple series contact type the features of which are self evident. The inventor is E. R. Snyder, of New York City.

LETTER TO THE EDITORS.

The Plunger Electromagnet.

To the Editors of Electrical World and Engineer:

Sirs:—I note the criticism of Mr. Charles L. Dawson in your issue of May 27, page 980, and in reply beg to say that while his point in the first paragraph is well taken, in that most large electric companies do their designing in c. g. s. units, the writer has found the English units much more useful in shop practice, owing to the fact that the pull, range and general dimensions of electromagnets are given by customers in English units.

Referring to the second paragraph, 10,000 ampere-turns per square inch of core are assumed merely for convenience, although as Mr. Dawson points out "The results of the tests reported—would seem to indicate that the flux in any magnetic core material at saturation is proportional to the cross-sectional area, and that the magnetomotive force to produce saturation varies directly with the length of the core, as ordinarily held." As a matter of fact, the reader can use his own judgment as to the proper magnetomotive force by referring to Fig. 1, page 881 (May 13).

I thank Mr. Dawson for his criticism.

NEW YORK, N. Y. CHARLES R. UNDERHILL.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

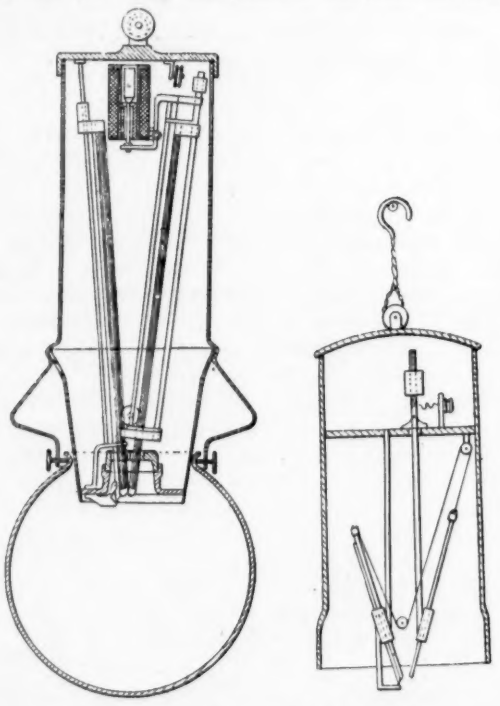
Single-Phase Commutator Motors.—RICHTER, SUMEC, PICHELMAYER, NIETHAMMER, EICHBERG.—Six communications on single-phase commutator motors. Richter considers Sumec's former exposition of the theory of the compensated series motor as extremely clear, and gives another proof of the result obtained by Sumec that the power factor of the compensated series motor is independent of the number of poles. It is impossible to improve the power factor of a series motor running at a certain speed by changing the number of poles. Sumec elaborates some points in his former article. Pichelmayer endeavors to show the error in the opinion of Lamme and Niethammer, who hold that it is possible to improve the power factor by increasing the number of poles. —*Zeit. f. Elek.* (Vienna), May 28.—Niethammer points out that there exists no essential difference of opinion concerning the theory. Only if the number of field conductors per pole is maintained constant with varying number of poles, the power factor is independent of the number of poles.—*Zeit. f. Elek.* (Vienna), June 4.—Eichberg criticises some special points in Sumec's article and Sumec replies to these cricitisms in *Zeit. f. Elek.* (Vienna), June 14.

Compensating Armature Reaction. BROWN.—An abstract of a paper read before the Newcastle Section of the (Brit.) Inst. Elec. Eng., in which the author discussed the work of Deri and Ryan and the methods adopted by Brown, Boveri & Co., Sauter, Harle & & Co., and Lundell.—Lond. *Elec.*, May 26.

Design of Dynamos.—FRITH.—A paper read before the Manchester Section of the (Brit.) Inst. Elec. Eng., giving a collection of labor-saving formulas for use in the design of dynamos.—Lond. *Elec. Rev.*, May 26.

LIGHTS AND LIGHTING.

New Arc Lamp.—ARENDT.—An illustrated description of the Beck lamp, which is essentially a flame arc lamp, the carbon being impregnated with light-emitting substances and producing a long arc. The construction of the lamp is shown in Fig. 1. The two carbons are arranged side by side in a slightly inclined position. One carbon (the left one in the illustration) is fixed, with respect to its longitudinal direction; the other, right hand carbon, being adjusted in position by means of the lever shown at the top. This lever is operated by means of an electromagnet, shown in the center at the top of the lamp. When no current flows the two carbons touch each other at their terminals at the bottom. When the circuit is closed the right hand carbon is deviated sideways (to the right hand) and removed from the left one (as a result of the action of the electromagnet) and the arc is started. The deviation of the right hand carbon is limited so that a constant distance between the two carbons is maintained. The electromagnet is entirely closed and contains only a few windings through which the main current flows. The lower terminals of the carbons are surrounded by a cast-iron reflector, the inside of which is of white enamel. The left carbon (for direct current, mostly the positive carbon) has not an exact circular cross-section, but is provided with a rib, which is shown at the left, and by means of which it rests on a support mounted at the bottom of the reflector. Above the lower support surface there is provided a small chamber surrounding the carbon rib and protecting it against the air. The purpose is to let the carbon burn off in such a way that a fine point always remains at the end of the rib. This fine point is the point on which the left



FIGS. 1 AND 2.—NEW ARC LAMP.

carbon rests. It is stated that it burns off very uniformly and slowly, so that the carbon electrode is fed downwards very gradually and uniformly. The support on which the fine terminal point of the carbon rib rests remains relatively cold. The right hand carbon, which has a completely circular cross-section, is fed downward simultaneously with the left hand carbon by means of the mechanism shown in Fig. 2. The most economical current is stated to be 6 to 12 amperes for direct or alternating current for an e.m.f. at the terminals of 42 to 46 volts. Wedding has tested a direct-current lamp for 9.1 amperes at 44.2 volts, which gave without globe, 2469 hemispheric c.p., corresponding to a consumption of 0.163 watt per candle. The maximum of illumination, which is 3800 c.p., is perpendicularly below the lamp. Cored carbons are stated to be the best ones. For the 9-ampere lamp the diameter of the positive carbon is 8 mm. that of the negative carbon 7.5 mm. The length of the carbon is 330 mm. for the smallest type of lamp, which gives a carbon life of 8 hours. The lamps are built for carbon lengths up to 500 mm. For a carbon life up to 30 hours double lamps are used. Combinations of four lamps for giving 20,000 c. p. have also been built.—*Elek. Zeit,* June 8.

POWER.

Variable-Speed, Alternating Current Motors.—IONIDES.—A paper read before the Glasgow section of the (Brit.) Inst. Elec. Eng. on alternating-current motors in industrial service. For paper calendars the usual requirements are (1) the dead slow speed for threading in the paper; (2) minimum speed for calendering certain classes of paper; (3) top speed for calendering other classes of paper. These requirements can be met in the following manner with induction motors: There is a small auxiliary motor driving the main motor through a worm gear and free wheel clutch, so as to give the required slow speed for threading in. The main motor is wound and connected to a controller of the tramway type, so that the coils of the stator can be grouped to form eight poles, at which the medium speed would be obtained, or four poles, at which full speed would be obtained. In this particular apparatus the supply is at 25 periods per second, and consequently the speeds of the motor are 360 and 720 revs. per min., making the usual allowance for slip. The changing from dead slow to half speed and from half speed to full speed is obtained by means of tappings from a pair of auto-transformers and a number of notches on the controller, whereby a gradual increase in voltage is applied to the motor as the controller is moved from notch to notch. This insures an even acceleration, and prevents any tearing of the paper. It would have been equally feasible to have wound the motor with 12 and 8 poles, so as to give three-quarter and full-speed, or other combinations. The controller is placed remote from the motors for the convenience of the operator, and all movements are controlled by one handle. The whole apparatus is no more costly than direct-current apparatus to accomplish the same results would have been, and the operation is equally satisfactory. A modified form of this arrangement for paper calenders can be used to great advantage on other classes of work; for example, in the driving of air compressors or hydraulic pumps. In this arrangement the motor is wound for two speeds, i. e., tappings are brought out from the windings so that the coils may be grouped to give full speed and half-speed, or full speed and three-quarter speed, as the case may be, and connected to a double-throw switch, which when thrown in one direction will give the full speed, and in the other direction will give the half-speed. A still simpler form of this speed changing device can be used on squirrel-cage motors employed to drive machine tools and punching and shearing machines, where different speeds are required, and in this case the switch, which changes the grouping of the coils in the motor is simply operated by hand. As an example: A 10-h.p motor is used to drive a punching and shearing machine. For very heavy work the motor is required to operate at about 75 per cent of the speed at which lighter work could be done. To meet this requirement, the tappings for the grouping of the coils should be so arranged as to give three-quarters or full-speed. If half-speed and full-speed are required, the tappings could be arranged accordingly. The output of the motor is varied in direction proportion to the change in speed, i. e., a 100-hp motor at 480 revs. per min. will give 75 hp at 360 revs. per min. and 50 hp at 240 revs. per min.; but the efficiency at any of these speeds is as high as it is possible to obtain within a very small percentage. As the power required to drive most machinery varies directly as the speed at which it is driven, the output of the motor corresponds very nicely with what is required of it. These examples refer to those cases in which certain fixed speeds meet the requirements. If, however, it is necessary for the motor to have a speed variation of perhaps six or eight to one with the possibility of being able to run continuously, and with a high efficiency at any intermediate speed, the shunt-wound, direct-current motor operating on two or more voltages has heretofore been used. The author points out the advisability of the single-phase series motor and recommends the use of this motor controlled by an induction regulator, which is a boosting transformer placed in series with the motor. The regulator or transformer raises or lowers the voltage, depending on the relative position of the primary, which is moved in relation to the secondary by means of a worm-wheel gearing. Any voltage requiring from zero to full-line pressure can be applied to the motor, and consequently any required speed can be obtained. —Lond. *Elec.* May 26.

Electric Transmission and Distribution in New England.—An illustrated description of the two sub-stations of the Connecticut Railway & Lighting Company at Waterbury, Conn. Electric energy

is supplied to these stations from the hydro-electric plant of the New Milford Power Company at Bull's Bridge, on the Housatonic River, in the town of Kent, Conn. The three-phase transmission lines from Bull's Bridge run to sub-station No. 1, which is located on the west bank of the Naugatuck River, on the outskirts of Waterbury. The lines carry three-phase, 60-cycle current at 33,500 volts, and this is delivered to the plant at Waterbury, over thirty miles distant, with a loss ranging from 4 to 7 per cent. The e.m.f. is stepped down in the sub-station to 2,300 volts for overhead transmission through the town of Waterbury to sub-station No. 2, which is situated in the center of the town. Current at a potential of 33,000 volts is also transmitted through sub-station No. 1, where switches are provided, to sub-stations at New Britain and Cheshire, thus giving a transmission circuit over 40 miles long, which is the longest in New England. Sub-station No. 1 is devoted almost entirely to railway and arc light work. The railway lines are supplied with a 600-volt direct current through rotary converter sets. The arc lights are supplied through tub transformers. Sub-station No. 2 is devoted entirely to commercial lighting work, which is fed from the Edison three-wire system, rotary converter sets in this station supplying the direct current. The article is profusely illustrated and the equipment of both stations is described in detail.—*Amer. Elec.*, June 1905.

Pumps.—An illustrated note on the installation of an electrically driven high-pressure turbine pump recently installed in a British colliery in place of a steam-driven pump. Also a note on the installation of motor driven centrifugal pumps for service on sewage disposal works.—Lond. *Elec.*, June 2.

Norwegian Power Plant.—THRUE.—An illustrated description of the water power development of the Gravfos Falls for transmission to the city of Drammen, a distance of 22 miles. There are at present 4,400 hp available. Three-phase currents are generated at 5000 volts and transformed up to 20,000 volts for transmission to the sub-station at the entrance of the city of Drammen. There the voltage is reduced to 4500 for distribution to a number of single transformers placed in different parts of the city. In these transformers the voltage is again reduced from 4500 to 220 to supply a low-voltage distribution network.—*Elek. Zeit.*, June 8.

Softening Water.—LECLAIR.—An abstract of a paper read before the Dublin section of the (Brit.) Inst. Elec. Eng. on softening water for steam raising. The author gives an interesting table showing the chief salts which cause temporary and permanent hardness and the treatment required for their removal, together with the reactions which take place.—Lond. *Elec. Rev.*, May 26.

Gas Engines.—RIEDLER.—The first part of an illustrated serial on large German gas engines.—*Iron Age*, June 22.

TRACTION.

Single-Phase Traction in Italy and Safety Devices.—KERBABER.—An illustrated article on the Roma-Civita Castellana line, on which the single-phase system of the Westinghouse Company will be

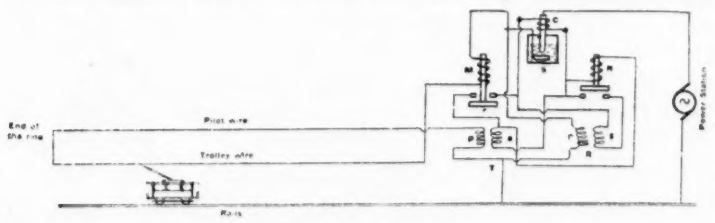


FIG. 3.—SINGLE-PHASE TRACTION.

adopted. Many stiff gradients are met with, including one of 1 in 14 for about half a mile. The power station will be at Ponte Milvio, 2.5 miles from Rome, and will be equipped with 300-hp steam turbines, driving 600-volt, single-phase alternators. The line between Rome and Ponte Milvio will be operated at 550 volts, the remaining section at 6,000 volts, the frequency being 25 cycles per sec. Between Rome and Ponte Milvio, where a pressure of 550 volts is used, there are two No. 00 trolley wires of copper of high conductivity. From Ponte Milvio to Civita Castellana there will be used only one No. 0 trolley wire. In order to render a pressure of 6,000 volts permissible on a public road, it is necessary to employ such a system that, should the trolley wire break down at any point of the line, the current will be cut off at the same moment at the power station. Furthermore, the current must also be cut off in the case of a short-circuit on the line, or of a current flowing in excess of the limits of safety. Fig. 3 is a diagram showing the system adopted. The apparatus includes an automatic oil circuit-breaker *S*, with its coil *C*; two electromagnets *M* and *N*; and two transformers, *T* and *R*. When the line is in its normal working condition, the current supplied to it goes through the electro-magnet *M*, but is not strong enough for operating the latter, which, therefore, remains always open. On the other hand, the transformers *T* and *R* have their primaries always connected on 6,000 volts, so that at the terminals of their secondaries there is a certain constant pressure. Furthermore, the secondary of *T* is always connected with the

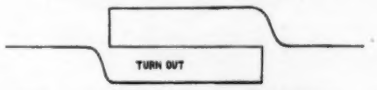


FIG. 4.—SINGLE-PHASE TRACTION.

terminals of the electromagnet *N*, and keeps its armature in the "open" position. Suppose, first, that a short circuit happens on the line; then the electromagnet *M*, which is in series with the trolley wire, carrying a current stronger than the normal value, draws up the core and closes the circuit through the secondary of the transformer *T* and the coil *C*, thus opening the circuit breaker. Suppose now that the trolley wire or the pilot wire breaks down at a certain point of the line. In this case, as the trolley wire and the pilot wire are in series, no current will go through the primary of the transformer *T*; therefore the pressure at the terminals of its secondary becomes zero, and no current can go through the coil of the electromagnet *N*. The core of the latter comes down, closes the circuit through the coil *C* and the secondary of the transformer *R*, and consequently trips the circuit-breaker. One of the difficulties of the system described in its application at the turn-outs, because if the two wires run in parallel, it is impossible to avoid danger, due to the breakage of one of them. It has been proposed, however, to use the arrangement shown in Fig. 4; by this means the safety of the system is maintained, but the construction of this part of the line requires much care and intelligent supervision. The line in question will have no feeders at all, a No. 0 copper wire being sufficient for the whole length with the high pressure used; every three miles there will be placed section insulators which consist of a neutral wire fixed to two or more poles, to which are fixed also the two ends of the live trolley wire. At the point, however, where the change of voltage has to be effected, the neutral wire has a length of about 40 yds., and there is a special switch which can connect this wire with one or other of the two voltages, but never both at the same time. This switch is erected just at the front of the power station, and one of the station attendants will be entrusted with its operation.—Lond *Elec. Rev.*, June 2.

Hot Air in New York Subway.—An editorial discussion of the cause of the high temperature in the New York subway. It is pointed out that practically all the electrical energy which is consumed in the subway for lighting and traction purposes is changed into heat. With the exception of the force used in overcoming inertia, the power of the motors is expended in overcoming friction, or in other words, is converted into heat. Moreover, in the last analysis, even the force used to overcome the inertia of the trains is converted into heat, for when the brakes are set to retard the train the heat developed at the surfaces of contact between the brake shoes and the tires is equivalent to the electric energy originally expended in overcoming inertia. Some data on temperature measurements are given, showing that the subway air is at present from 4 to 6 degrees hotter than the surface air above. A calculation is given showing that sufficient electrical energy is changed into heat in the subway in order to heat the whole of the subway 200 times a day to a temperature six degrees higher than the outside temperature. If this volume of air is to be supplied the subway air must change 200 times in 24 hours, or practically once every 7 minutes. There are more than 30 stations in the 10 miles, with an average of nearly 4 entrances and exits to each station, or 120 openings for ventilation, of which half, or 60, may be assumed as intakes for the outside air. If these intakes average 70 square feet in cross-section, the air will need to pass through them at a velocity of about 10 miles an hour to change the subway air 200 times in 24 hours, or once in 7 minutes. It appears that in reality the subway air is changed far more frequently than is necessary for perfect sanitary requirements, even

allowing 3,000 cu. ft. per hour per person. The problem of ventilation of the subway, then, is not a problem of sanitation, but a problem of keeping the subway temperature down to reasonable limit.—*Eng'ing News,* June 15.

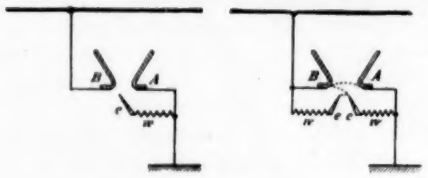
Steel Wheels.—Fowler.—A comparison of the cost, life and other characteristics of cast iron and steel wheels. The author concludes that the adoption of the steel wheel in street railway work should be both rapid and extensive.—*St. R'y. Jour.,* June 17.

India.—An illustrated article on the conversion of the Calcutta tramway system from horse traction to electric traction. The equipment is modern and is specially adapted to the peculiarity of tropical and local conditions.—*St. R'y. Jour.,* June 3.

Single-Phase Locomotive.—Storer.—An illustrated description of the 135-ton, single-phase locomotive exhibited by the Westinghouse Elec. & Mfg. Co. at the recent International Railway Congress.—*Elec. Journal,* June.

Installations, Systems and Appliances.

Lightning Arresters.—Dina.—A long article, illustrated by diagrams describing the various arrangements by which it is possible to obtain a suitable length of air-gap at relatively low voltages, say at a few thousand volts. The most suitable length of air-gap is said to be three to four millimetres. All attempts at lengthening



Figs. 5 and 6.—Lightning Arresters.

the air-gap by giving special forms to the electrodes, for instance by using very sharp edges, have proven unsuccessful, because after numerous discharges the sharp edges are destroyed. Other inventors have introduced an artificial air-gap which starts the discharge. Either the heat effect or the ionizing effect of the ultra-violet light of the discharge starts a discharge through the main air-gap. One construction is shown in Fig. 5, in which *Be* is the auxiliary air-gap and *BA* is the main air-gap. A modification is shown in Fig. 6, in which there are really three successive discharges. First between *ee,* then between *B* and *e* and finally the main discharge from *B* to *A*. Further modifications of this scheme are possible by using successive auxiliary air-gaps like *ee,* one below the other and with decreasing lengths of the gap so that the

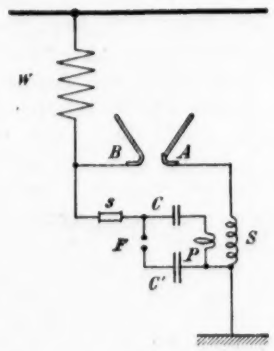


Fig. 7.—Lightning Arrester.

lowest and shortest air-gap is first acted upon, which starts the discharge through the next one, and so on. The disadvantage of these methods is that the auxiliary air-gap must have a short length and is liable to be changed in time; moreover the wind may blow the discharge from the main gap to the auxiliary air-gap and it may remain where there are not special devices to extinguish the arc quickly. Another principle is that of Elihu Thomson (U. S. patent 495,858). The author then describes the Siemens-Shuckert lightning arrester, which is shown in Fig. 7. The scheme is to use a special circuit in which high frequency oscillations are produced. *W* is the damping resistance and *B A* the main air-gap. *C C*$_1$ are condensers, *F* is an auxiliary air-gap, *P* the primary and *S* the secondary of a Tesla transformer. When the voltage at the plates of the condenser *C* (which is practically equal to the voltage between line and earth) reaches the value to which the air-gap *F* is adjusted, the condenser *C* discharges partly through the circuit *C F C*$_1$ *P*, i. e., it transfers a part of its charge to the other condenser, *C*$_1$ high frequency currents being produced. Thjs discharge depends in no way on the methods by which condenser *C* has been charged (that is, on the causes of the excessive rise of voltage in the line). The oscillating currents in the primary *P* produce a high e.m.f. in the secondary *S* of the Tesla transformer, so that now a higher voltage exists between *B* and *A* and the discharge from *B* to *A* is started. This higher e.m.f. is without any danger to the line. The main advantage is that there is no direct effect from the auxiliary air gap *F* on the main discharge gap *BA*. It is, therefore, possible to enclose *F* in a suitable tube and place it at some distance from the main discharge. The apparatus is called a "lightning arrester relay." It is built with an air-gap *BA* of 4 mm. for about 3000 volts effective current and with a gap of 3 mm. for about 2000 volts.—*Elek. Zeit.,* May 25.

Static Disturbances in Transformers.—Kintner.—An article in which the author first explains, with the aid of diagrams, the causes of the static disturbances sometimes observed on the low-tension side of a transformer with a high ratio of transformation. To prevent serious trouble, a discharge spark gap may be connected between the middle point of the low tension side of the transformer to be protected and the ground. When single transformers are worked in groups for polyphase transformations, the discharge gaps must be properly connected to the group. A series of diagrams is given, showing the connections for various polyphase systems. Only one spark gap is used in all groups save that of the two-phase independent circuit, which is in reality two independent single-phase circuits. The gap should be attached to the neutral point of the group when possible, and under all conditions it should be attached as near to that point as possible. No spark gap discharges should be used on transformers supplying a rotary converter that has one leg of the direct-current circuit connected to ground.—*Elec. Jour.,* June.

Installations.—A great many special problems concerning details of installations and wiring have been discussed in the form of questions and answers during the past four years in the journal; an alphabetical index of the different problems dealt with is now given in *Elek. Zeit.,* May 25.

Regulations.— A reprint of the revised regulations of the British Board of Trade for local authority undertakings in the provinces of Great Britain.—Lond. *Elec.,* May 19.

Safety Regulations.—Weber.—A report of the Committee of the German Association of Electrical Engineers for considering safety regulations.—*Elek. Zeit.,* June 1.

Wires, Wiring and Conduits.

Insulating Materials.—A table giving various properties of the most important insulating materials. The properties dealt with are average perforation voltage for an alternating current at 50 periods, inflammability, specific weight, method of treating, machining, and other details. Fifty different samples of 15 different materials are dealt with.—*Elek. Anz.,* May 25.

Drum Carriage.—An illustrated description of a new carriage for cable drums, designed for the purpose of lessening the labor of loading and unloading.—Lond. *Elec.,* June 2.

Electrophysics and Magnetism.

Production of Radium from Uranium.—Soddy.—An account of experiments in which he found that a quantity of uranium, originally practically free from radium, after being kept for a certain time in a closed bottle, showed the characteristic properties of the radium emanation. A certain amount of uranium had, therefore, been changed into radium, but the rate of this production was lower than should have been expected, if the radium atom resulted directly by the change of the uranium X atom. He gives reasons why we should expect that as polonium and radium are to be regarded as products of uranium, the other radio-active elements, especially actinium, present in pitchblende, probably had a similar origin and may, in fact, be the missing intermediate forms. One disintegration series is probably from uranium to radium to polonium to lead (or bismuth).—*Phil. Mag.,* June.

Metallic Resistance at High Frequencies.—Brocca and Turchini. —An account of experiments in which the authors tested Kelvin's

formula for the alternating-current resistance of wires for frequencies of several million per second by means of simultaneous thermal and electrodynamic measurements. They find that in non-magnetic metals, like copper and platinum, the deviations from the calculated values are slight for frequencies well under a million, but they exceed the errors of observation and follow a perfectly definite law. The variable $x = \delta \sqrt{4\pi cw\mu}$, by which Lord Kelvin calculated the ratio of the resistances, gives values which are too high or too low according to the frequency. For $x = 8$, the formula holds strictly. In the case of iron, the formula fails entirely, the current density being of paramount influence. The heating is much less than that which would correspond to its ordinary permeability below saturation.. The permeability to be inserted in the formula for x above, necessary to justify the values obtained, would be about 100. German silver also shows a distinct effect of the current intensity. When the current increases from an effective strength of 1 ampere to 1.4 ampere, the resistance of a German silver wire 0.59 mm. thick diminishes 5 per cent.—Lond. *Elec.*, May 26; from *Comptes Rendus*, May 8.

Flow of Electricity in Metals Under Changes of Pressure.—THWING.—An abstract of an Amer. Phys. Soc. paper, giving an account of experiments on the flow of electricity in metals under changes of pressure. A bar of metal, *A*, is connected by a fine wire, *a*, of the same metal to one pair of quadrants of a sensitive electrometer. *A* is enclosed in a straw jacket and heated to 100°, while *a* is at the temperature of the room. When *A* is heated the electrometer is charged negatively. When *A* is cooled the electrometer is charged positively. If *A* is enclosed in a stout tube of steel, insulated in oil, and hydrostatic pressure applied, the charge obtained is positive, and for pressures of 10-20 atmospheres is in the case of some metals as much as 0.1 volt.—*Phys. Review*, June.

ELECTROCHEMISTRY AND BATTERIES.

Electric Furnace in the Iron and Steel Industries.—BORCHERS.—A review of the present condition of the manufacture of iron and steel in the electric furnace. The author gives an outline of the more important electric furnace procsses which have been devised or introduced into practice. He concludes that the experiments which so far have been made and which have given real results, were made by experimenters who were able electrical engineers, electrochmists and furnace designers, yet were more or less unacquainted with the iron and steel industries, at least when they began their experiments. He thinks the time has not yet come to say exactly what may be accomplished with the electric furnace in this field. But the time is now ripe for experienced iron and steel men to take up the problem.—*Stahl und Eisen*, June 1.

Filter Presses.—HATSCHEK.—An illustrated article on the materials for the construction of filter presses for use with various solutions. He deals especially with iron, gun metal and wooden presses and the use of various materials for the fittings, etc. The use of hard-rubber liners and cocks is mentioned. The author concludes that there is practically no substance requiring to be filtered on a commercial scale for which a suitable filter press cannot be made.—*Electrochem. and Met. Ind.*, June.

Magnetic Separator.—An illustrated article on the Buchanan magnetic separator.—*Iron Age*, June 22.

Refractories.—JOHNSON.—A communication pointing out the importance of selecting the proper refractory materials for metallurgical furnaces and the problems which are involved in different cases.—*Electrochem. and Met. Ind.*, June.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Bolometer for the Absolute Measurement of Radiation.—CALLENDAR.—An abstract of a (Brit.) Phys. Soc. paper. The electric compensation method in which the heat received by radiation on a metallic strip is determined by measuring the electric current required to produce the same rise of temperature in the strip, is the most satisfactory and accurate method for absolute measurement. Two methods have been used for this purpose: The thermo-electric method and the bolometric method of Kurlbaum, in which the rise of temperature produced by the radiation or by the electric current is measured by the increase of resistance of the metallic strip itself. The author points out the advantages of the latter method and describes some improvements which he has introduced.—Lond. *Elec.*, May 26.

Inductance Standards in Varying Temperatures.—TAYLOR.—An abstract of an Amer. Phys. Soc. paper. The standard variable inductance examined was of the familiar Aryton-Perry type, consisting of two coils wound on portions of concentric spherical mahogany frames. It was thought that temperature variations might produce unequal expansions in different portions of the wooden frames and so alter the configuration of the coils as to produce an appreciable difference between inductance values when used at different temperatures. The results were in all cases practically negative. At least it is safe to say that for the standard tested, as probably for others of the same type, the variation of inductance with temperature is less han 1-40,000 per degree centigrade.—*Phys. Review*, June.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Transmission of Photographs.—WILL.—An illustrated article on Korn's electric method for transmitting photographs. At the transmitting and receiving station two drums are revolving synchronously. At the transmitting station there is used a hollow glass drum on which the photograph to be transmitted is rolled off in the form of a transparent film. The receiving station has a sensitive film rolled on a hard-rubber drum. A thin light ray passes through the film on the transmitting station and drops on a selenium cell, which is combined with a storage battery, the transmitting line and apparatus of the receiving station to one circuit. According to the picture on the film, more or less light passes through it so that the resistance of the selenium cell is accordingly diminished to a greater or less extent. The current passing through the line varies correspondingly so that at the needle of a galvanometer in the receiving station changes its position accordingly. By this means more or less resistance is inserted in the local circuit of a Geissler tube, so that the tube emits more or less light. A fine ray of light emitted from the tube falls on the film of the drum of the receiving station and blackens the same more or less and in accordance with the degree of blackness of the corresponding part of the film on the transmitting station. Since both drums revolve synchronously and are simultaneously displaced in a longitudinal direction (like a phonograph record), the picture of the transmitting station is reproduced in form of a helical line on the film of the receiving station. Several transmitted and received pictures are reproduced, and it appears that the similarity in each case is quite satisfactory. It is stated that in general the received picture makes the person appear younger since little wrinkles are not reproduced. The more characteristic lines in the face are clearly shown. If the drums make one revolution in 12 seconds, pictures of a size of 12 by 18 cm. are transmitted in 12 to 24 minutes.—*Elek. Anz.*, June 4 and 8.

Wireless Telegraphy.—DUDDELL AND TAYLOR.—The first part of an illustrated paper read before the (Brit.) Inst. Elec. Eng. The authors endeavored to get quantitive data; they measured the effective value of the current in the receiving air wire and determined as far as possible how this current depends on the arrangement of transmitting and receiving apparatus and the distance between them. The paper is to be concluded.—Lond. *Elec.*, June 2.

BOOK REVIEW.

AMERICAN STREET RAILWAY INVESTMENTS. (The Electric Traction Red Book.) Twelfth Annual Volume. 415 pages, with maps. New York: McGraw Publishing Company. Price, $5.

We are glad to welcome the latest issue of this admirable and valuable publication, so long a standard work of reference in its field. The new edition contains 415 pages of statistical matter or 53 pages more than the edition of 1904. This increase has been due partly to the addition of reports from new roads, and also to the fact that many roads have furnished a statement of earnings for the first time this year. Among the new features in the manual this year is an increase in the index. Heretofore only the names of the companies reported have been included in the index, but this year it has been enlarged to include the names of all underlying companies which have bonds outstanding, even though the company may not at this time have any separate corporate existence. This enables investors to refer readily to the report of the company which now operates the road of any former company.

The introduction to the book contains a summary of the gross receipts for the last two years of the principal companies reporting. As there have been many consolidations during 1904, this table is

not an exact index of the growth of the business, as the figures in a number of cases represent receipts for a larger amount of trackage. Nevertheless the increase is such a steady one as to indicate a substantial gain in street railway earnings for the past year. It is interesting to note that 43 companies showed gross income of $198,644,802; 30 companies showed $21,483,088; 144 companies showed $31,783,234; 106 companies showed $7,661,972, and 82 companies showed $3.138,982. It will thus be seen that 405 companies reported earnings above $272,000,000, from which it would be a conservative inference that the street railways in the United States—from 1,200 to 1,500 all told—have the splendid income of $300,000,000 based on an average fare per passenger of less than 5 cents, in return for which they give a service without parallel in the world for speed, distance covered, comfort and convenience, all due to electricity.

Test of Reeves Vertical Cross-Compound Engine.

Professors R. C. Carpenter and H. Diedrich, of Cornell University, give in a recent report the data of a test of a Reeves vertical cross-compound engine. The engine itself is the vertical cross-compound type controlled by Rites shaft governor. There is no receiver, the steam from one end of the high pressure cylinder entering the corresponding end of the low pressure cylinder. The engine was run both condensing and non-condensing. In the latter case the dimensions were 12 inches and 20 inches by 14 inches; when run condensing, a liner was put in reducing the diameter of the high pressure cylinder to 10½ inches.

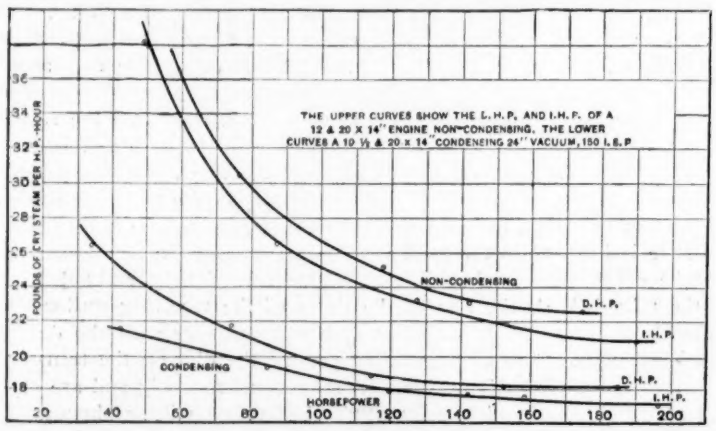

THE UPPER CURVES SHOW THE I. H. P. AND I.H.P. OF A 12 & 20 X 14" ENGINE NON-CONDENSING. THE LOWER CURVES A 10 ½ & 20 x 14" CONDENSING 24" VACUUM, 150 I.S.P
POUNDS OF DRY STEAM PER H.P. HOUR
NON-CONDENSING
D.H.P.
I.H.P.
CONDENSING
D.H.P.
I.H.P.
HORSEPOWER

FIG. I.—HORSE-POWER CURVES.

The accompanying curves give the data of the test. In the report two points are noted about these curves. The cut-off even at high loads does not seem to be late enough to cause any marked rise in the steam consumption at overloads; in most cases little or no rise could be determined. The curves show good economy over a wide range of load, the efficiency falling off but slightly on overloads.

Belted-Type Rotating Field Alternator.

A line of belted type, self-contained, rotating field, alternating-current generators, such as shown in the illustrations, has recently been placed on the market by the Westinghouse Electric and Mfg. Company. The machines are built for single, two and three-phase circuits, in sizes from 30 to 200 kw. The single phase generators are manufactured for 220, 440, 1100 and 2200 volt circuits at 7200 alternations, and besides these the polyphase machines

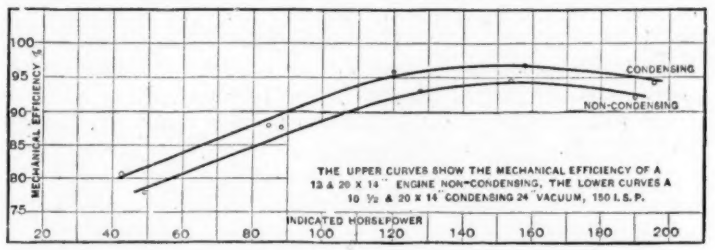

MECHANICAL EFFICIENCY %
CONDENSING
NON-CONDENSING
THE UPPER CURVES SHOW THE MECHANICAL EFFICIENCY OF A 12 & 20 X 14" ENGINE NON-CONDENSING, THE LOWER CURVES A 10 ½ & 20 X 14" CONDENSING 24" VACUUM, 150 I.S.P.
INDICATED HORSEPOWER

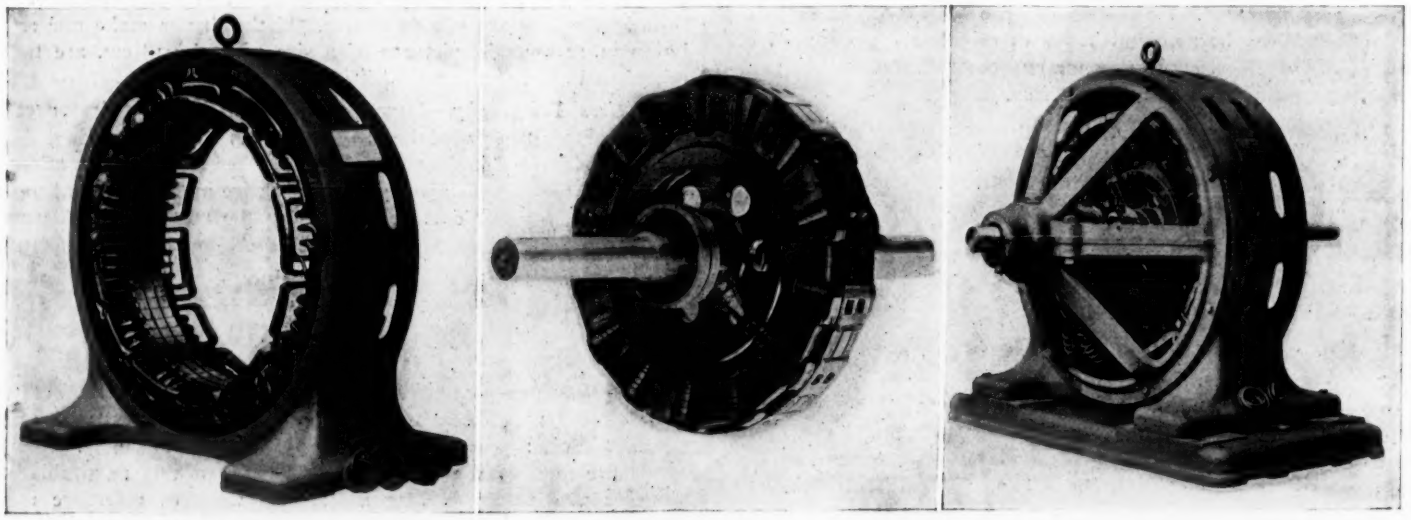
FIG. 2.—EFFICIENCY CURVES, REEVES ENGINE.

are wound for 6600 volts and both 3000 and 7200 alternations. In this type of generator the armature is stationary, a construction which facilitates the insulation of its windings, and provides that the field current instead of the armature current pass through the brushes and collector rings. Alternators of this type are, therefore, especially adapted to high voltages or large current output.

The frame of the stationary armature is cast in one piece with slots machined on the inside for holding the punchings which receive the windings; these are composed of wire, strap or bars, depending on the size and voltage of the generator. Open slots are employed in machines up to 75 kw. with coils held in place by hard fiber wedges.. In the larger machines partially closed slots are used. Horizontally split brackets, which carry the bearings, are bolted to this cast iron frame. All generators have bed plates with large foundation areas and suitable belt tighteners, and may also be arranged for direct connection to an engine or water wheel.

The fields of the smaller generators are of cast steel with pole caps of the same material. The poles of larger sizes are laminated and keyed or dovetailed to a cast iron spider. The field coils are composed of square wire so wound as to expose the maximum surface. In the generators having laminated poles heavy brass wedges, which hold the field coils in place, retard any shifting of the field between the poles, and thus practically eliminate pumping between the generator and any rotary converters or synchronous motors which may be connected in the system and insure satisfactory parallel operation of two or more generators. A large shaft insures cool running of the bearings, and the absence of any distortion which might result from the pull of the belt.

Every means has been utilized for the rapid dissipation of heat from all parts of the machines. Open spaces in the laminated field register with those in the armature, and during operation air is drawn in through the field spider and forced out through the



FIGS. 1, 2 AND 3.—ROTATING-FIELD ALTERNATOR.

stationary core and windings, thus insuring low operating temperature. Excellent regulation is obtained by properly proportioning the armature and field windings in preference to saturating the magnetic field.

The single-phase generators have compensating field windings supplied with rectified alternating current. A commutator on the shaft adjacent to the collector rings, has its brushes connected to the secondary of a series transformer in the armature circuit and its segments to the self-exciting field coils. The compensating winding is so designed that the generator can be adjusted for a practically constant voltage from no load to full load, or for an increase in voltage.

Recording Voltmeter for Both Direct and Alternating-Current Circuits.

Since it accurately, automatically and continuously furnishes a written record of the slightest variation of the voltage, the recording voltmeter has proven itself to be of great value, and is an indispensable part of a modern electric plant. With the recording voltmeters previously used it had been necessary to furnish each instrument with entirely different current coils, according as it was to be employed upon alternating or direct-current circuits. In many electric plants both alternating and direct current are produced, and it is desirable that the same voltmeter be capable of being used equally well for recording either kind of current.

The novel feature and improvements in the new voltmeter illustrated in Figs. 1 and 2 are: First, it is equally applicable to both alternating and direct circuit; second, it requires only one-third as much current to operate as that necessary for the older design for alternating currents; third, it is more sensitive to very slight variations of voltage; fourth, the chart graduations are nearly uniform on both sides of the working range; fifth, the portable form of the instrument in its carrying case is only half the size and weight that was formerly required.

FIG. 1.—STANDARD SWITCHBOARD METER.

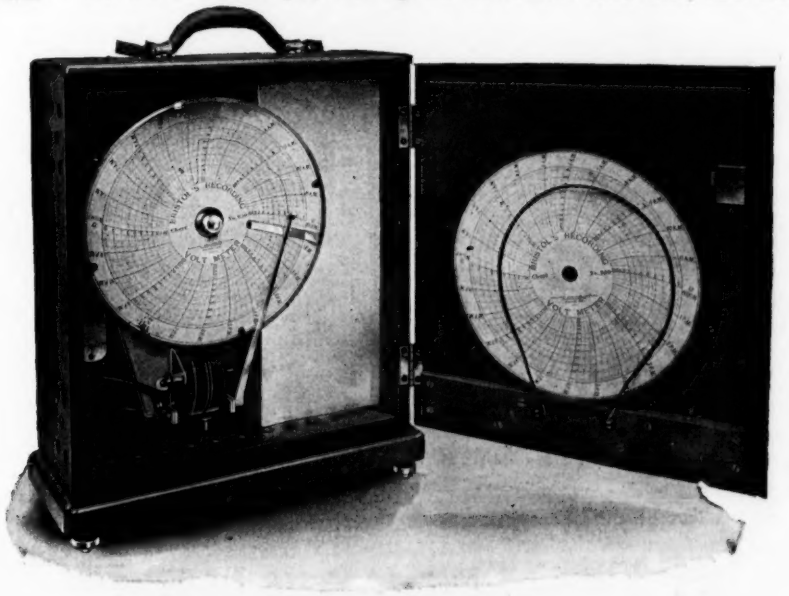


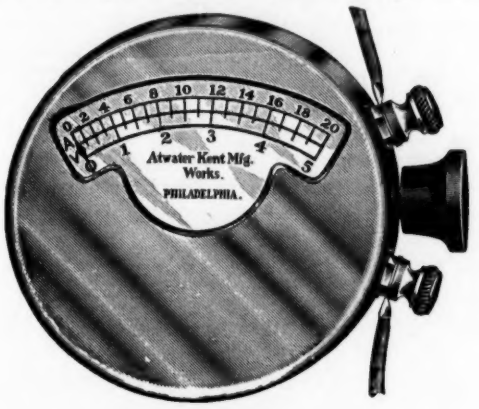
FIG. 2.—PORTABLE METER.

The solenoids shown in Fig. 2 are connected so that when current is passing through them in series the movable solenoid will be repelled from, instead of being attracted toward, the stationary one. The movable solenoid is mounted on a frictionless knife-edge multiplying device, which transmits its motion to the pen arm, carried by the knife-edge blade. This simple multiplying device permits the solenoids to be located very near each other, and consequently the magnetic field of force is uniform throughout the motion of the solenoid resulting in the desirable scale divisions of the chart.

By making the constructions of the solenoids so that there is repulsion instead of attraction, the mutual inductance between them is neutralized, thus making the same instrument suitable for recording either alternating or direct current. The instrument is independent of the rate of alternations and is compensated for changes of atmospheric temperature. This new type of recording voltmeter is manufactured by the Bristol Company, Waterbury, Conn.

A Pocket Size Ammeter.

The Atwater Kent Manufacturing Works, 112 North Sixth Street, Philadelphia, manufactures the new automatic volt-ammeter shown in the accompanying illustration. This ammeter is pocket size, and a hand-sewed leather case is furnished with each instrument. It is particularly adapted to automobiles and other kinds of work



AMMETER.

where an absolutely correct instrument of small size and not too high voltage is required. Another type recently brought out includes the use of a dash-pot, making the instrument dead beat, and the doing away with one of the two leads used in the old style. No change is made in the connection to the battery for the two readings, as that in amperes is obtained by simply pressing the button.

Shaw Non-Arcing Lightning Arresters.

The Lord Electric Company, Boston, which now owns and manufactures the Shaw system of non-arcing lightning arresters and static dischargers, after a special study of all the factors involved in the design of this class of instruments, has introduced important improvements intended to make them most efficient in action, and the parts interchangeable. In the construction of the improved Shaw non-arcing lightning arrester two metal caps are used, each having circular serrated edges. These caps are supported by metal brackets and they in turn support a hollow insulating tube on which are placed alternately mica washers and carbonized rings. These rings are of specially prepared high resistance carbonized material. In both the low and high-potential types this composition is formed into oval rings, affording a large surface of discharge area, and when placed in series with mica rings to supplement the air gap the resistance surface of the mica acts as a discharge plate and materially assists in presenting a continuous surface to the abnormal or static discharge. At the same time this combination of resistances will not

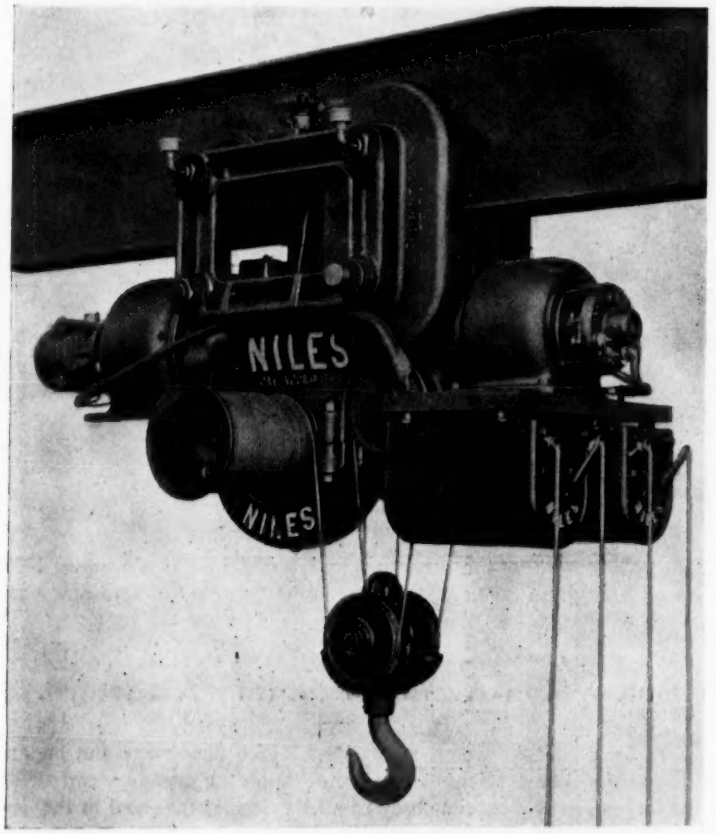
permit an arc to form or a dynamic current to precede or follow it. This high resistance feature and the peculiar shape of the rings afford one of the many advantages possessed by this form of arrester.

The supporting brackets are secured to the insulating base, which is raised from the bottom of the steel box in which it is enclosed, allowing the free circulation of air and preventing the formation of an arc between the box and instrument. As a further precaution the box is treated with a special insulating enamel.

The box itself is made of heavy pressed steel with a cover of the same material, held in place with winged screws. The openings in the sides of the box for circuit wires are provided with special insulating bushings, the whole making a compact and durable instrument of neat appearance, the several parts being so proportioned and distributed as to make the combined instrument convenient to handle, place and connect. All of the parts are readily accessible for inspection and test at all times.

New Niles Electric Traveling Hoist.

The new Niles electric traveling hoist shown herewith is designed for hard, continuous service, and, as may be seen in the illustration, is of compact design, being self-contained in a heavy cast-iron frame to which the motors are attached end-on. The power is transmitted directly from the armature shaft to the drum shaft through a train of worm and worm wheel gears. The traversing mechanism is also driven through one train of worm and worm-wheel gears, similar to the hoisting mechanism, except that, when the trolley is arranged to run on a single I-beam, a



TRAVELING HOIST.

double set of transmission gears is used. All the mechanism is enclosed in oil and dust-proof casings, and is absolutely noiseless in operation. In addition to the braking effect obtained by the use of the worm and worm wheel. a powerful electric brake is attached to the hoist motor.

These hoists when mounted on a traveling bridge may be used as small capacity cranes. When used as cranes, the hoists are arranged to run between the two I-beams or channels of the bridge, and the controllers for raising and lowering the hook and operating the traversing mechanism may be placed either on the hoist, on the bridge, and operated by cords from the floor, or in an operator's cage attached to the bridge.

The Niles hoists are built in capacities of ¾ to 6 tons and are usually arranged to run on an I-beam track. They will run on straight and curved tracks, and are generally provided with a separate motor for traversing; but if desired hand traverse may be furnished, or all the traversing mechanism may be omitted and the trolley moved along the track by pushing on the load. The increased service of the electric traverse, however, much more than compensates for the slight additional cost.

Star Cable Dog.

To meet the demand for some means for fastening cables to side walls by appliances which, although serving to hold the cables securely in place, may readily be removed when desired, there has been developed the cable dog shown in the accompanying illustration. The dog is made of galvanized malleable iron in two wedge-shaped pieces. Its form is such that when inserted a positive expansion

CABLE DOG.

occurs on the inner end. A hole is drilled just large enough to insert the shank and then the wedge part is hammered in. Pressure with a hammer or chisel will loosen the wedge, thus releasing the hold, and allowing its easy removal, and the dog is ready for use elsewhere when desired. The "Star" cable dog is manufactured by the Star Expansion Bolt Company, 147 Cedar Street, New York.

Exhibits at the National Interstate Telephone Convention.

The telephone convention held at Chicago, June 20 to 22, brought out by far the largest and best exhibits of telephone apparatus yet displayed at a national convention. All past differences having been settled by the consolidation of the Interstate and National Associations the manufacturers responded heartily to the invitation to support the convention by making exhibits and in other ways.

THE AMERICAN STEEL & WIRE COMPANY occupied two rooms, one of which was entirely taken up with a huge pyramid made up of coils of all kinds of wire used in telephone construction.

EWING-MERKLE ELECTRIC COMPANY, which is now getting extensively into the telephone business and has appointed L. G. Le Bourveau manager of its telephone department, exhibited a number of its "Everbest" specialties, and the "Everbest" magazine was found everywhere around the convention hall A new receiver and the Mason lightning arrester were among the new things shown. This company is the agent for the Sumter Telephone Manufacturing Company, of Sumter, S. C., and also handles miscellaneous telephone construction material along with electrical supplies.

THE INTERNATIONAL TELEPHONE MFG. CO. made a small exhibit, which served to bring out the excellent mechanical details of its receivers, transmitters and switchboard apparatus. President Shafer, First Vice-President McCormick, and F. L. Middleton, manager of the sales department, were in attendance, as well as several other representatives.

THE ADDRESSOGRAPH COMPANY had exhibit quarters, which showed addressing machines of much interest to those in the clerical departments of telephone companies.

THE NICHOLAS TELEPHONE SELECTOR CO., of Rochester, N. Y., exhibited a system whereby central office can call any one of a number of parties on the same line. The Nicholas lightning arrester was also shown.

THE MILLER ANCHOR COMPANY, Norwalk, Ohio, occupied half of a parlor with exhibits of anchors and augers for setting anchors.

THE FIBRE CONDUIT COMPANY, Orangeburg, N. Y., showed lengths of its impregnated fibre conduit both before and after treatment with compound, and distributed some interesting data relative to underground conduit construction of this kind.

THE T. & A. SELECTIVE CALL COMPANY, Geneseo, Ill., showed a selective attachment and central relay for use on old telephones by which any party on a rural line can call another without calling central, and can also call central without calling any other party.

THE AUTOMATIC ELECTRIC COMPANY, of Chicago, showed its standard automatic exchange apparatus with some slight improvements. It also showed a four-party line system for use on the automatic exchange. This system has selective ringing and is non-interfering.

FRANK B. COOK, Chicago, made an extensive exhibit of protective devices and terminal heads. A multiple distribution box, which is sealed so as to do away with the necessity of pot heads, was one of the newest features.

MORGAN & WRIGHT, Chicago, had an exhibit of insulated tape, in charge of E. S. Hilton.

THE DEAN ELECTRIC COMPANY, Elyria, Ohio, showed a fine line of switchboards, which testified to the large amount of engineering talent in the company. These switchboards include many excellent details which space does not permit to be described here.

M. B. AUSTIN & Co., Chicago, had as the great feature of their exhibit the Meinema selective ringing lockout system shown as applied to an eight-party line. The exhibit was in charge of Mr. Meinema, the inventor.

THE ELECTRIC APPLIANCE COMPANY, of Chicago, had its telephone department well represented by an exhibit in charge of H. M. Remington and S. A. Densmore. President Low was also a frequent visitor to the convention.

THE MONARCH ELECTRIC & WIRE COMPANY, Chicago, made an exhibit of wire and telephone construction material.

THE CENTRAL TELEPHONE & ELECTRIC COMPANY, St. Louis, which handles everything in the way of telephone apparatus and supplies, made a representative exhibit.

THE ILLINOIS ELECTRIC COMPANY, Chicago, showed a large number of constructive specialties which it handles, including the Davis protective devices.

THE WESTERN TELEPHONE MFG. CO., Chicago, showed magneto call switchboards with improved drops and plugs and also a new non-interfering party line calling system.

THE CENTURY TELEPHONE CONSTRUCTION CO., Buffalo, gave special prominence to its four-party selective system for local or common battery exchange work. This works by throwing positive or negative direct current on the side of the line desired. Another special feature of the exhibit was the platinum electrode transmitter. The exhibit was a large and representative one.

THE STERLING ELECTRIC COMPANY, Lafayette, Ind., chartered the whole of the writing-room of the Auditorium Hotel, in which it set up a number of switchboards and apparatus in working order. The switchboard exhibit consisted of one section of a 3,000-line multiple board going to Green Bay, Wisconsin; one section of a 100-line lamp signal board going to Seymour, Ind., a private branch exchange board going to a South American bank, and a chief operator's desk going to Depere, Wis. A four-party line system was shown with selective ringing.

THE NORTH ELECTRIC COMPANY, Cleveland, Ohio, made a good-sized exhibit of telephones, switchboards and accessories, supplemented with photographs of recent work.

THE MALTHANER ELECTRIC MFG. CO., of Minneapolis, attracted considerable attention with its telephone ringing apparatus, which, with five cells of dry battery, will ring as many telephones bridged across the line as are ever likely to be put on one rural circuit. This remarkably high efficiency is secured partly by a skilfull design of the induction coil and pole changing apparatus, and partly by the fact that the mechanical motion of the pole changer is stopped whenever there is no ringing to be done. In other words, the pole changer operates only during a ring; hence no energy is necessary to keep a vibrator in motion at unnecessary times.

THE DENIO GENERAL ELECTRIC COMPANY, Rochester, N. Y., was able to show telephone exchange men how they could add to the popularity of telephone service by means of a new fire alarm, which can be connected to any subscriber's circuit and is available as a fire alarm at any moment. A fire alarm message by this system is transmitted directly to fire headquarters. It involves no modifications of existing telephone circuits and does not interfere with telephone service except at the instant an alarm is being sent in. It can be used in connection with a thermostat system to indicate the presence of fire in a building.

THE STROMBERG-CARLSON TELEPHONE MFG. CO. was, as usual, represented by a very large exhibit occupying several rooms on the parlor floor of the hotel. This exhibit was very complete, including the company's most representative apparatus, both in telephone instruments and switchboards. The instruments for mines and interurban electric railways have been like the other instruments of the company, brought to a high state of perfection. The company's factory being easily accessible from the hotel, excellent opportunity was offered to visit the factory and see the even more complete lines of apparatus there available as well as the processes of manufacture.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, besides occupying several parlors near the convention hall, had a sample of its switchboard work in the Auditorium lobby. Invitations were everywhere prominent for the delegates to visit the company's new factory located at Englewood, State and Sixty-fourth Streets, Chicago. The company recently moved from the down-town west side manufacturing district to this location, which is much better suited to a modern factory, in which light, air and shipping facilities are important considerations.

THE SWEDISH-AMERICAN TELEPHONE COMPANY, as usual, occupied a prominent place just off the main parlor of the Auditorium Hotel, where abundant room was available to exhibit this company's telephone switchboards and accessories as well as to receive visitors.

THE MONARCH TELEPHONE MFG. CO. occupied two parlors with exhibits of its new switchboard apparatus and also a full line of instruments. E. E. Yaxley, general manager, and a large corps of traveling representatives, were in attendance.

THE MOON MANUFACTURING COMPANY, in its exhibit of terminal and protective devices, made a specialty of the Moon self-soldering terminal heads.

THE ADJUSTAPHONE for conveniently supporting desk telephones was exhibited by the Chicago Writing Machine Company.

THE CHICAGO TELEPHONE SUPPLY COMPANY made an extensive exhibit.

THE BURDICK SIGN COMPANY made an exhibit of signs for advertising purposes, which is an indication of the increasing interest of telephone exchange managers in advertising.

THE HALLER MACHINE WORKS, Chicago, had an electric sign in a prominent place in one of the halls in connection with a flasher, to remind delegates that this was a good way of advertising.

THE EUREKA ELECTRIC COMPANY, Chicago, made an exhibit of telephones and accessories.

THE ACKERMAN-BOLAND TELEPHONE COMPANY made a neat display.

GEORGE CONOVER, manufacturer's agent, Chicago, was in attendance and had headquarters and an exhibit.

THE GRAY TELEPHONE PAY STATION COMPANY exhibited its well-known coin-in-the-slot devices for telephone use.

THE SKELLEY telephone holder was on exhibition.

THE FARR TELEPHONE COMPANY, Chicago, exhibited telephones and accessories.

THE BAIRD TELEPHONE PAY STATION COMPANY was prominently represented by an exhibit.

THE WILLIAMS TELEPHONE & SUPPLY COMPANY showed its various telephone products.

RABER & WATSON were among the exhibitors.

THE AMERICAN ELECTRICAL SUPPLY COMPANY, which has recently entered the field, occupied a parlor, where, to quote one of its officers, it was engaged in getting acquainted and showing a few of the specialties it handles.

THE NATIONAL CARBON COMPANY had an exhibit of granular carbon, also carbon for batteries and protectors.

THE FISK-NEWHALL TELEPHONE MFG. CO. was among the exhibitors.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Seasonable weather has had a decidedly beneficial effect upon business in general. Agricultural products are feeling the influence of the favorable weather and are in better condition. Western wheat harvesting is now well under way, while late planted corn and cotton are rapidly recovering lost ground. These are the most important commercial influences at this season of the year, jobbers' advance orders being largely dependent upon local conditions at the interior, and manufacturers gauging their activity by the outlook for fall and winter distribution. It is noticeable that moderate midsummer transactions are not productive of price concessions to stimulate forward business, owing to a general sentiment of confidence in the future. In the leading manufacturing industries there is less idle machinery than is customary at this time of inventories, especially at plants making textile fabrics, despite the fact that prices of raw materials are somewhat inflated. Normal midsummer quiet in the iron and steel industry is occasioning no anxiety, conditions being much better than they were at this time last year, and confidence is expressed in the tonnage of orders that will appear next month, while it is expected that full production will be required after Aug. 1. *Braastreet's* reports 157 failures during the week, against 175 for the previous week and 215 for the corresponding week of 1904. The Middle States had 41, New England 27, Southern 30, Western 28, Northwestern 10, Pacific 20 and Territories 1. Domestic consumers of copper continue to buy small quantities of the metal as their needs warrant, and this continued hand to mouth buying is undoubtedly responsible for the firm undertone to the market. The quotations are nominally unchanged at 15c. for prompt shipments of both Lake and electrolytic and 14¾c. for casting grades.

CANADIAN WHITE COMPANY.—The announcement is made of the incorporation in Canada of the Canadian White Company, Limited, to carry on a general contracting and engineering business on lines similar to J. G. White & Co., Incorporated, of New York; J. G. White & Co., Limited, London, England, and the Waring-White Company, London, England. The letters patent of the incorporation were granted the latter part of May, and the organization of the company is now practically completed. The Canadian White Company, Limited, will carry on a general contracting and engineering business and will undertake civil, mechanical, electrical, hydraulic and building work. It will be fully equipped to handle large construction contracts for steam or electric railways, and will be prepared to design, build, equip and operate electric lighting plants and power installations, gas works, water supply, sewage systems, piers, docks, harbor works, office buildings, apartment houses, hotels, etc. The contracting and engineering departments of J. G. White & Co., Incorporated, of New York, will at all times be at the service of the Canadian company, and the company will further have the benefit of the experience of J. G. White & Co., Limited, London, England, and the Waring-White Building Company, London, England. This insures the Canadian company, from its inception, the benefits and advantages to be derived from a very long and successful experience in the contracting and engineering business. The Canadian company has upon its board as stockholders strong representative business men well known throughout Canada. The general manager of the company will be a prominent civil engineer with large experience in railway construction, etc., and who has held executive positions. Mr. H. P. Douglas, formerly vice-president and general manager of the Canadian Otis Elevator Company, Limited, is treasurer of the company. Mr. H. C. Hitch has been secured as superintendent of building construction. Mr. Hitch has been for several years connected with the Thompson-Starrett Company, of New York, as superintendent. Recently he has had full charge of the erection, for the Thompson-Starrett Company, of the Union Bank Building, at Winnipeg. This is one of the largest and most important buildings in Canada, and the record made by Mr. Hitch in connection with this and previous work, insures the efficient handling of the building department. This company will make a feature of building construction, this work being carried out along the lines of the Waring-White Building Company, Limited, of London, which has on hand at the present time contracts aggregating several millions of dollars. The company has an authorized capital of $1,000,000, of which $500,000 is common stock and $500,000 is 6 per cent cumulative preferred stock, preferred as to assets, as well as dividends. After both kinds of stock have received dividends at the rate of 6 per cent per annum, the preferred stock is entitled to share further with the common stock in any dividends declared up to a maximum of 10 per cent per annum, above which the common stock is entitled to any residue.

CINCINNATI NORTHERN TRACTION COMPANY.—The Westinghouse Electric & Manufacturing Company has just closed a contract for the equipment of the main generating station and four rotary converter substations of the Cincinnati Northern Traction Company. The power house will be located at Hamilton, Ohio, and the original installation will be of 5,000 kilowatts capacity, with provisions for ultimately increasing it to 10,000 kilowatts. In the generating station will be located three 1500-kw, and one 500-kw, three-phase, rotating-field, enclosed turbo-type generators, and three 300-kw rotary converters. Current will be generated at 375 volts, thus avoiding the necessity of lowering transformers for the main station rotaries. The outgoing lines will then be equipped with raising transformers having a ratio of 375-33,000 volts. Each generator will be driven by a Westinghouse-Parsons steam-turbine and excited by a direct-current generator attached to the end of the turbine shaft, from which its power will be derived. Each sub-station will contain a 300-kw rotary converter supplied by three 33,000-375-olt step down transformers. All transformers are of the oil insulated, self-cooling type. Besides the above, the contract includes all necessary switchboards and protective devices for the control and protection of apparatus in the power house and rotary stations.

WESTINGHOUSE TURBINES FOR BROOKLYN TRACTION.—The Brooklyn Heights Railroad Company has recently closed contracts with the Westinghouse Companies, Pittsburg, Pa., for two 7,500-kw turbine type generating units for extending their present power house equipment in Brooklyn. These units will be the largest generating units of the turbine type in the world. With the guaranteed overload capacity of 50 per cent above rating, the turbines will thus be capable of developing 16,000 brake horse-power and about 10,500 brake horse-power on normal load. The turbines will operate on dry steam at 175 pounds pressure and a vacuum of about 28 inches. Three-phase, 25-cycle current will be generated directly at 11,000 volts for distribution to the line. It is of interest in this connection that the second and third largest turbine generating units in the world are also of the Parsons type, the former built abroad and the latter by the Westinghouse Companies at Pittsburg. The Brooklyn Heights contract is especially significant from the fact that the company had already contracted about a year ago for a Westinghouse-Parsons turbine unit of the largest capacity then built—5,500 kw. The building of the new machines will mark an important step in the development of power station apparatus.

WESTINGHOUSE ORDERS.—Ten Westinghouse electric locomotives have been ordered for use on the Metropolitan Railway of London, England, of 1,200-hp capacity each, to operate 120-ton trains at an average speed of thirty-six miles an hour. They will be equipped with four motors of 300-hp capacity each. A feature of the engines will be that, owing to the terminal facilities being somewhat restricted, it has beeen determined to adopt motors of a smaller size than usual, equipped with forced ventilation, so as to keep down the length of the locomotives to convenient limits for handling. The Japanese engineering and contracting firm of Takata & Company has received contracts for vertical, single acting, simple and compound engines, from the Akabane, Kure, Tokio and Yokoska arsenals, the Kiushiu and Nippon railways, the Fukagawa and Tokio electric light companies, the Furukawa Western Bureau, the Tokio Imperial University, the Yokohama Electric Wire Works and the Tokio Water Works, aggregating in all about 8,000-hp. All this apparatus will be of Westinghouse construction.

ELECTRO-HYDRAULIC PLANT FOR JAPAN.—Takata & Company, 10 Wall Street, New York, have placed an order for an electro-hydraulic plant for the Kanazawa Electric Light Company, Kanazawa, Japan. It will consist of a Westinghouse 120-kw, rotating armature alternator, 2,200 volts, 60-cycles, three-phase, to be direct coupled to a 22-inch, high-pressure, horizontal Victor turbine made by the Platt Iron Works, Dayton, Ohio. The turbine is to be capable of developing 230 actual horse power at the shaft, under a working head of 190 feet, running at 720 r.p.m. Some of the power of this wheel will be used in operating other apparatus in addition to the 120-kw generator. To furnish excitation a 2-kw machine will be driven from the generator shaft. To control the above alternator and exciter, there will be a standard Westinghouse white marble switchboard equipped with Westinghouse instruments. For governing a Lombard type "Q" 8 x 16 governor has been ordered. The complete plant will be shipped overland by way of the Pacific coast, and it is hoped to get the complete plant in Japan by the first part of October.

STANLEY WATTMETERS.—The Stanley Instrument Company announces that it has changed the design of its well known Model H, rotating, jewel-bearing wattmeter, whereby its efficiency is improved, and at the same time the instrument placed in conformity with the suggestion contained in the opinion of U. S. Circuit Court of Appeals, which decided that the former type infringed the Tesla split-phase patents. The Court stated: "If the device stopped with a 'metallic rotating body,' and some method other than a counting machine operated by it was used for determining the number of revolutions, we might not be able to charge the respondent with infringing. We might then well apply the proposition of the respondent that a mere meter is in a different art from a motor; but, as it does not stop there, we must look further." The Stanley Company states that, under the advice of counsel, and conforming to this suggestion of the Court, it is manufacturing wattmeters in which the train mechanism, or "counting machine," will not be operated by the disc or "metallic rotating body," but by a totally independent mechanism. The "counting machine,"—the train or registering mechanism—will be operated or driven by a spring which will relieve and prevent the "metallic rotating body," the disc, from operating or driving the train, thereby complying in the minutest particular with the suggestion of the Court expressed in the following language: "Therefore, as it may well be that, if the counting mechanism was of a kind not operated by the 'metallic rotating body,' we should not be compelled to find infringement." It is stated that not only will the "metallic rotating body" (the disc) not operate the "counting mechanism" or the registering train, but error in the meter due to train friction will be removed; consequently, in the new wattmeters with registering train operated independently of the disc, besides the advantages of the rotated jewel bearing, the spring-supported pivot, the absence of vibration effects, mechanical or electrical, the adaptability for any frequency from 40 to 140 cycles, and the ease and simplicity of installation, calibration and adjustment, is included also the entire absence of error due to train friction.

STEAM TURBINE EQUIPMENTS FOR RAILWAY SERVICE.—An important contract for a 10,000-hp power house equipment has just been awarded to the Westinghouse Companies, Pittsburg, Pa., by the Fort Wayne & Wabash Valley Traction Company, of Fort Wayne, Ind. The entire electrical equipment, comprising both three-phase and two-phase apparatus, the former for railway and the latter for lighting service, will be built by the Westinghouse Electric & Manufacturing Company, and the steam turbines by the Westinghouse Machine Company. The principal apparatus covered by the contract comprises two 1,500-kw and one 400-kw turbo-generator units, delivering 375 volts, three-phase, 25-cycle currents to rotary converters; two 1,500 and one 500-kw turbo units, delivering 2,300 volts, two-phase, 60-cycle currents to step-up transformers for the lighting system. Four rotary converters; seven 375-kw, fifteen 75-kw, six 100-kw, and three 150-kw, oil-insulated, self-cooling transformers; four switchboards for 125, 550, 600 and 2,300 volts. Low equivalent lightning arresters, choke coils and disconnecting machines are included in the equipment. The steam turbine equipment is to be of the standard Westinghouse-Parsons type, operating under 150 pounds steam pressure, a moderate vacuum and with dry saturated steam. Many distinctive features will be embodied in the arrangement of the new power house now building. The Fort Wayne & Wabash Valley Traction Company controls all the city lines in Fort Wayne and La Fayette, Ind.; the Logansport Street Railway Company and the Logansport, Rochester & Northern Traction Company in Logansport; the Fort Wayne & Southwestern Traction property from Fort Wayne to Wabash; the Wabash River Traction Company and the Wabash-Logansport Traction Company, operating from Wabash to Logansport, and the electric lighting plant in Fort Wayne. Contracts have also been closed with the Westinghouse Companies by the Grand Rapids-Muskegon Water, Power & Electric Company, of Grand Rapids, Mich., for two 1,500-kw three-phase, 6,600-volt turbo-generator outfits with two 20-kw, engine-type exciters. The voltage will be raised for transmission by three 1,000-kw, oil-insulated, water-cooled transformers and finally lowered for distribution by three transformers of the same size and type. The apparatus will be controlled from a 660 and a 6,600 volt switchboard.

WATER POWER IN MAINE.—Plans have been developed at Bangor, Me., for the purchase and development of the Bodwell Water Power Company, as a nucleus upon which will be developed a company with a capital of a million dollars for the purpose of selling electricity in Penobscot valley and the surrounding country. An immense power plant will be built at Milford, across from Oldtown. It is expected that construction of concrete dams will commence immediately. W. C. Johnson, expert consulting engineer of Niagara Falls; A. B. Leach, of the big banking house of Farson, Leach & Company, of New York; Mr. Olmstead, of New York, and Mr. Mesleck, of Chicago, have recently visited Milford with Carl P. Dennett, of Pear & Dennett, who conceived the idea of the formation of such a company.

LARGE WATER VALVE.—The Pratt & Cady Company, of Hartford, Conn., has completed the manufacture of probably the largest valve ever built. It was constructed for the Niagara Construction Company and will be used to regulate the flow of water through the sluiceway at Niagara Falls before it reaches one of the big turbine wheels at the electric plant. The valve weighs 126,000 pounds. Its length is 26 feet, its width is 11 feet and its height is 7 feet 6 inches. The diameter of the opening is 9 feet. The mechanism stood well all the tests that were applied to it, and an order has been given for another valve of the same dimensions.

ELECTRICITY FOR A FORT.—Bids have been opened at Portland, Me., in the office of Captain A. W. Yates, quartermaster U. S. army, for the construction of barracks at Fort Williams and for an electric lighting and power system at Fort McKinley. The bids were complete and were as follows: For an electric lighting and power distributing system at Fort McKinley, Malcolm W. Hill Company, Boston, $14,441; Edwin C. Lewis, Boston, $12,998; Joseph W. Roman & Company, New York City, $16,730. Electrical wiring, York & Boothby, Portland, $195. G. H. & E. E. Lowell, South Portland, $267.

POWER DEVELOPMENT IN MEXICO.—The syndicate of London capitalists which composes the Encinillas Mines, Ltd., is arranging to establish a large electric power plant a Santa Rosalia, Mex. It is proposed to dam the Conchos River and generate electrical energy. Captain C. O. Greenwall, representing the Encinillas Mines, Ltd., says that a separate company will be organized to carry out the electrical project. It is proposed to not only supply Santa Rosalia with lights and power, but to also build transmission lines to other towns in that part of the state.

CHIHUAHUA TRANSMISSION.—Colonel W. C. Greene, of New York, who recently obtained a concession from the Mexican Government for the establishment of a large electric power and transmission plant in the western part of the state of Chihuahua, is now in Mexico for the purpose of directing the inauguration of the work on the industrial enterprise. The power plant will be located on the Aros River near Guaynopa. The electric power will be transmitted to a number of mining camps of that part of Mexico.

MEXICAN ELECTRICAL PROJECTS.—Senor Miguel Rubio Ocampo, owner of the electric plant at Zitacuaro, state of Michoacan, Mexico, proposes to install a lighting plant in Maravatio, in the same state. A concession has been granted for an electric railway and lighting plant in La Piedad Cabadas, Michoacan. A telephone line will be built from Chucandiro to the state capital. Senor Teodoro Garduno, manager of the State of Mexico Bank, is installing a hydro-electric plant in Tacambro.

ORDERS FOR FINISHED STEEL.—The Philadelphia Rapid Transit Co. has signed a contract for 24,000 tons of fabricated steel for the elevated structure in Philadelphia. John Claflin has placed an order for 3,000 tons of steel for his new 34th street store, in New York. The American Bridge Co. secured both orders, making the total placed with that company within the last few days approximately 40,000 tons.

LARGE SOUTH AMERICAN CONTRACT.—Bryant Brothers, of New York City, have been awarded a contract by the Peruvian government, it is stated, for building a complete railway system at Iquitos and the construction of one of the largest electric lighting and heating plants in South America. This is in addition to a contract for a telephone system in the same city at a cost of about $1,000,000.

ELECTRIC LIGHT EQUIPMENT WANTED.—Messrs. Mahan & Thompson, Cherryvale, Kan., are contemplating the installation of a small electric light and power plant at this place. They are in competition with natural gas, and want to get a first-class plant as reasonably as possible. They want prices on dynamos, boilers, engines, construction material, supplies, etc., for a 500 to 1,000-light plant.

CATALOGUES WANTED.—The Hewitt Electric Company, a new firm, has opened a store at 55 Webster Street, North Tonawanda, N. Y., to do a general electric construction and supply business. The firm desires catalogues and price lists of electrical supplies, fixtures and novelties.

MEXICAN POWER PLANT.—H. G. Harvey will establish a large electric power plant on the Aros River, near Tomosachic, in the Guerrero district, state of Chihuahua, Mexico. A large waterfall will be utilized for the purpose of generating electrical energy.

THE LOS ANGELES RAILWAY COMPANY recently called for bids for three 1,000-kw motor-generator sets.

AMERICAN DRILLS ABROAD.—Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, has recently returned from Europe where he spent six weeks in the interest of the company. He brought with him orders for 3,400 tools for shipment from America, representing a value of over $300,000. Mr. Duntley states that the trip was the most successful he has ever experienced, and, owing to the growing demand for pneumatic tools in England and on the Continent, it was found necessary to extend the organization of the foreign business. In order to accomplish this, the factory and business of E. G. Eckstein, Berlin, Germany, and that of the Lencke Company, St. Petersburg, Russia, were purchased, and will be operated for the purpose of meeting these requirements in the continental countries. Pneumatic tools are rapidly being introduced in shipbuilding and other industries in Russia, Austria, Germany, Italy, France, etc., and a largely increased demand for the various devices is anticipated. The line of electric drills exhibited and demonstrated was extremely successful, and large orders received therefor. Owing to the fact that all European countries are well equipped with electricity, the electric drill is destined to rival the air drill in time and opens up a field which heretofore could not be solicited. The profits earned through the extension of the foreign business will accrue to the benefit of the Chicago company. The English courts on May 17 rendered the final adjudication of the patent litigation instituted by the English company, which decision sustained all of the company's claims, 52 in number, covering pneumatic hammers, thus leaving the English company in a particularly strong position with reference to its patents. Its plant, located at Fraserburgh, Scotland, is now in full operation. The American business, according to President Duntley, shows a very satisfactory increase in volume, and all factories, both American and foreign, are operating overtime. The month of May was the largest month in the history of the company.

THE COPPER SITUATION.—The *Copper Gossip* of the National Conduit & Cable Company remarks as follows under date of June 21: "The market for copper has displayed a very steady undertone during the past three weeks, and this seems to be the natural result of the extremely heavy movement into buyers' hands. Demand is making an excellent showing alongside of production, and the large rate of world consumption has proved a constant source of strength to the situation for the last six months. The mining companies are producing more copper than last year, but they are also exporting more than ever before. On no other conditions could present values be long maintained. Home and foreign buyers covered a large proportion of their requirements last month, and consequently current business does not equal the heavy transactions in May. Consumers and exporters, however, have placed fair-sized orders for delivery between now and August, and both local and European interests continue to replenish their stocks to a moderate extent as opportunity offers. Quotations continue at 15 cents for electrolytic wire bars, and on this basis there seems to be no ground for complaint as long as supply and demand remain as well balanced as at present. Of course a very decided change in these factors would be more than likely to have its effect, one way or the other, on the selling price. Production is large, and at some of the more important points there is a marked increase in the quantity turned out. But demand is following close on the heels of output, and reliable reports indicate that stocks have undergone a decrease. With the statistical position so favorable to firmness, the danger of serious fluctuations is minimized."

FRENCH WESTINGHOUSE CONTRACT.—Single-phase railway work is being pushed in Europe. The French Westinghouse Company has received a contract for the installation of its single-phase railway system on the Bergama, Valle Brembana Railway, Italy. This is the second single-phase railway contract secured by this company in that country, the first being the Rome-Civita-Castellana Railway. The length of the line is 30 kilometers, and it will be operated by five 30-ton locomotives, equipped with four 75-hp single-phase motors, with multiple unit control, and pneumatically operated bow trolleys. The gage of the track will be 1.44 m. The power station will be about 1 km. out of Valle Brembana, and will be equipped with three single-phase, 500-kw alternators, running at a speed of 500 r.p.m. There are to be no transforming substations, and the line will be fed at the initial pressure direct from the power house.

UNITED STATES' FOREIGN COMMERCE.—The foreign mercantile commerce of the United States during the fiscal year which is now nearly ended will be the largest on record in the history of the country. For the twelve months ending May 31 the total trade was larger than in any corresponding twelve months, and when the figures are made up for June, it is altogether likely that the totals will show that for the twelve months ending June there was an unprecedented total of commerce. During the twelve months ending May the total imports and exports of merchandise amounted to nearly $2,600,000,000. During the eleven months ending May the total of exports and imports was $2,425,000,000 against $2,376,000,000 in the corresponding eleven months of the preceding year. Other figures are cited on our editorial page.

ENLARGING SOUTH NORWALK PLANT.—The Board of Electrical Commissioners, of South Norwalk, Conn., has awarded to the Fort Wayne Electric Works the contract for the electrical equipment for the enlargement of the city electric light plant. The contract for the power equipment was awarded to the American Diesel Engine Company for $16,000. The price of the electrical equipment, as awarded to the Fort Wayne Electric Works, is $3,700. The distribution system will also be enlarged. The entire work will be executed under the personal direction of the three electrical commissioners, Messrs. Joseph A. Volk, Col. Leslie Smith and Charles N. Smith, with general superintendent A. E. Winchester as their supervising engineer in charge. The engine and generator will be direct-connected.

ELECTRICAL INSTALLATION CONTRACT.—The contract for the complete electrical installation for the new 19-story annex to the Frick Building, Pittsburg, Pa., has been let by the architects, D. H. Burnham & Co., to the Iron City Engineering Co., Pittsburg, Pa. This company has also secured the contract for the electric wiring in the 12-story office building for Col. Henry Schmulbach, Wheeling, W. Va.; also the electric wiring for the crusher and brick plant of the Bessemer Limestone Co., Bessemer, Pa. It is at present installing the conduit and wiring systems in the Home of the Good Shepherd, Pittsburg, Pa., and the B. & O. passenger station, at Youngstown, O.

ENLARGING LYNN WORKS.—The General Electric Company will build a number of new buildings at the river works plant on Saugus River, Lynn, and plans have been completed for three. They will be constructed of brick and steel, two will be 120 by 200 feet, and the third 80 by 200 feet and 35 feet high. A large portion of the sides and roof will be of glass. The company further contemplates the erection of a group of dwellings for workmen on land owned by the concern near the Saugus River factories.

BIG CRANK SHAFTS.—The Bethlehem Steel Company is at work on three crank shafts which will weigh 86,000 pounds each when finished. They are turned out of solid steel ingots 25x4x4 ft. and are intended for three Snow gas engines, which are to drive 4000-kw Crocker-Wheeler alternators, the largest gas-engine-driven generators ever built, ordered by the California Gas & Electric Corporation, details for which have already been given in these pages.

BIDS FOR NAVY SUPPLIES.—Bids will be received July 18 at the Bureau of Supplies and Accounts, Washington, for furnishing at the navy yards, at Portsmouth, N. H., Boston, Mass., Newport, R. I., New York, N. Y., and Washington, D. C., a quantity of naval supplies as follows: Incandescent lamps, motors, motor drive, electrical supplies, wire cable, etc. H. T. B. Harris, Paymaster-General, U. S. N., is the official interested.

X-RAY FOR ARMY.—Six portable X-ray machines, costing $6,000, are to be purchased by the United States Government for use in army hospitals and in the field where bases shall be established. The machines will weigh 1,350 pounds each, and will be operated by gasoline.

Financial Intelligence.

THE WEEK IN WALL STREET.—There was a general advance in prices on the New York Stock Exchange, attended with a corresponding degree of activity and strength. The electric and traction stocks shared in the general improvement, and some of the principal issues closed the week with good gains to their credit. The tendency just now is upward, all things pointing in that direction. Metropolitan Street Railway closed at 124½, ex. div., this being a net advance of 3¼ points. Interborough Rapid Transit was quiet, closing at 202½, a net gain of ¼-point. Brooklyn Rapid Transit was active and advanced 3⅞ points net, closing at 67¾. Philadelphia Rapid Transit, which is now dealt in on the New York Stock Exchange, advanced 1 point during the week, the closing price being 115. Among the electric stocks, Allis-Chalmers preferred lost a fracton in closing at 51, while Westinghouse made a net gain of 1 point, closing at 169. The last quotation of General Electric was 174½, ex. div. Western Union made a net gain of ⅝-point, closing at 94. The curb market was generally quiet during the week and did not share in the activity of the Stock Exchange to any extent. Following are the closing quotations of June 27:

NEW YORK

	June 20	June 27		June 20	June 27
Allis-Chalmers Co.	14⅛	13⅜	Electric Vehicle pfd.	21	20⅛
Allis-Chalmers Co. pfd.	55	50⅛	General Electric	174⅛	175
American Tel. & Cable	93	90	Hudson River Tel.	..	..
American Tel. & Tel.	142	142	Interborough Rap. Tran.	202	201
American Dist. Tel.	32	29⅛	Metropolitan St. Ry.	125⅛	124¼
Brooklyn Rapid Transit.	66	68⅝	N. Y. & N. J. Tel.	..	..
Commercial Cable	..	..	Marconi Tel.	..	..
Electric Boat	35	28	Western Union Tel.	94¼	93⅞
Electric Boat pfd.	80	75	Westinghouse com.	167¾	166
Electric Lead Reduction	..	..	Westinghouse pfd.	..	..
Electric Vehicle	17	16			

BOSTON

	June 20	June 27		June 20	June 27
American Tel. & Tel.	142⅜	142⅛	Western Tel. & Tel. pfd.	..	100
Cumberland Telephone	119⅛	119	Mexican Telephone	1⅛	1¼
Edison Elec. Illum.	*245	244	New England Telephone	140	*139
General Electric	175	174¾	Mass. Elec. Ry.	19⅜	18⅛
Western Tel. & Tel.	19⅛	18¾	Mass. Elec. Ry. pfd.	62⅜	61⅛

PHILADELPHIA

	June 20	June 27		June 20	June 27
American Railways	52	50⅛	Phila. Traction	..	100
Elec. Storage Battery	80	78	Phila. Electric	8⅝	8⅝
Elec. Storage Battery pfd.	..	..	Phila. Rapid Trans.	27¼	27⅛
Elec. Co. of America	11⅞	11⅜			

CHICAGO

	June 20	June 27		June 20	June 27
Central Union Tel.	..	..	National Carbon pfd.	120	117
Chicago Edison	..	..	Metropolitan Elev. com.	25	23⅞
Chicago City Ry.	*190	..	Union Traction	..	..
Chicago Tel. Co.	..	..	Union Traction pfd.	..	..
National Carbon	63	65			

* Asked.

NORTH AMERICAN REPORT.—At the annual meeting of the stockholders of the North American Company the directors whose terms expired were re-elected. The report of the company for the year ended December 31, 1904, is issued. The income account and the general balance sheets were published in April last. President Wetmore gives a long detailed statement of the operations of the company which is of interest to the shareholder. He calls attention to the fact that, as regards income account, the North American Company has not yet received dividends from two of its important investments, the surplus earnings, otherwise applicable thereto, having been devoted to construction work not yet completed. Referring to the increase of capital stock authorized on March 16, 1905 (130,000 shares), the report states that 71,045 shares were sold at par for cash, 55,310 shares were issued at par directly in part payment for shares of the Union Electric Light & Power Company and the Laclede Gas Light Company, and 3,645 shares remained unissued at the date of the annual report (June 21, 1905). Of the cash received from the sales of stock, after paying the loans appearing in the balance sheet of December 31, 1904, and completing payment for the interests acquired with the new stock, a balance of approximately $2,500,000 remained applicable to the future uses of the company, thus placing it in possession of sufficient cash working capital. The North American Company reports for fiscal year ended December 31:

RECEIPTS.

Interest received and accrued	$44,835
Dividends received	777,153
Other profits	147,878
Total	$909,866

DISBURSEMENTS.

Salaries, legal expenses, net rentals, etc.	$73,719
Taxes	4,605
Total	78,324
Excess receipts	891,532
Net increase in value of assets as readjusted Dec. 31 last	891,532
Total undivided profits	1,592,661
Previous profits	1,231,544
Total profits	2,824,202
Premium on 2,000 shares of stock issued during year	8,375
Total	$2,832,578
Dividends paid and accrued	840,834
Surplus	$1,991,745

This compares with a surplus reported previously to fiscal year ended May 31, 1904, of $739.33.

issued further issues can be made only to the extent of 75 per cent of the new construction completed. The remaining 25 per cent of the cost of new construction, in the past, has come out of the earnings and from the sale of stock to the Chicago Edison Company, which holds, through trustees, all of the stock of the Commonwealth Company.

ANALYSIS OF GENERAL ELECTRIC.—Curtis & Sederquist, of Boston, have issued the forty-third number of their series of letters, "Studies in Investment Values." It is devoted to General Electric. It is shown that gross earnings have increased in the last five years from $22,379,463 to $39,231,328. The floor space and the factories have increased from 2,000,000 to 4,100,000 feet. The number of employees has increased from 11,000 to 18,000. Although there has been a large gain in gross earnings, yet in the last two years operating expenses and cost of material have so much increased that net earnings have fallen off about $2,000,000, explained by the increased price of copper, expenditures in developing steam turbines, higher labor, lower selling prices during the business and financial depression of 1903 and 1904. The stock earned 17.6 per cent in the fiscal year ending June 1, 1905, against 22.4 in 1904 and 28.9 in 1903. These earnings are based upon an increased capitalization after a stock dividend of 66 per cent in 1902. It is shown that the company has a net working capital of $50,444,000, or $104 a share, on the outstanding stock. The factory plants are carried upon the books at $7,500,000. It is figured that their actual value is at least $20,000,000, or $41 a share on the stock. It is shown that in the last twelve years $17,000,000 in cash has been added to the value of the plants, of which $13,500,000 has been written off. Dividends have been paid regularly at the rate of 8 per cent. per annum on the stock since 1901. This in addition to the 66 per cent dividend declared in 1902.

MEXICAN LIGHT & POWER.—The Mexican Light & Power Company, at its Montreal meeting, gave authority to issue $6,000,000 of new bonds at 90, the purpose being to pay for the two Mexican light companies recently acquired. The amount necessary to liquidate this indebtedness will be $5,400,000 gold. The San Ildefonso Company, one of the corporations acquired, has a capital stock of $3,500,000 Mexican and a bond issue of 5,000,000 francs. The other corporation purchased was owned by Anthony Gibbs, Sons & Company, bankers, of London, and has a capital of £500,000. A holding company will take care of the two corporations purchased. It will be known as the Mexican Electric Light Company, Ltd. The Mexican Light & Power Company will own all the stock of the new corporation.

DIVIDENDS.—The directors of the Central & South American Telegraph Company have declared the regular quarterly dividend of 1½ per cent., payable July 7. Electric Storage Battery directors have declared the regular quarterly dividends of 1¼ per cent on both the common and preferred stocks, payable July 1. Directors of the Westinghouse Electric & Manufacturing Co. have declared the regular quarterly dividend of 2½ per cent. on the preferred and assenting and non-assenting stocks, payable July 10. The Washington Water Power Company has declared the regular quarterly dividend of 1½ per cent, payable July 1. A semi-annual dividend of $3 per share has been declared, payable July 10, on the preferred stock of the El Paso Electric Company.

CENTRAL & SOUTH AMERICAN TELEGRAPH.—The quarterly report of the Central & South American Telegraph Company shows traffic receipts of $300,000, an increase of $26,500 over the corresponding period a year ago. Operating expenses show a slight increase. After deducting the dividend there was a surplus for the quarter of $86,616, an increase of $27,300. The total surplus now stands at $1,195,708.

PHILADELPHIA BELL TELEPHONE.—The directors of the Bell Telephone Company, of Philadelphia, have decided to issue an additional $2,000,000 (40,000 shares) of stock to the stockholders of the company at par. The stockholders will have the right to subscribe for one share for every seven shares held at present. The subscription will open on July 5 and the right to subscribe will expire on August 1, 1905. This will make the capital of the company $16,000,000. It has no bonded debt.

MEXICAN TELEGRAPH.—The Mexican Telegraph Company reports traffic receipts for the quarter ended June 30 of $135,000, an increase of $16,500 over the same period a year ago. Operating expenses were larger by $4,000, leaving a balance of $108,000. There was a surplus after allowing for the dividend of $73,685, an increase of $7,300. The total surplus now stands at $1,845,239.

DETROIT EDISON BONDS.—Perry, Coffin & Burr, of Boston, and other firms are offering $300,000 of the Detroit Edison Co. first mortgage 5 per cent gold bonds, due 1933. The company expects earnings in 1905 to approximate $825,000 gross and $400,000 net. The business is growing rapidly.

UNITED STATES STEEL.—The United States Steel Corporation's net earnings for the first half of the calendar year—estimating April, May and June—will be at least 65 per cent. greater than for the first half of 1904; 13½ per cent. less than for the first half of 1903 and 18¾ per cent. less than for the first half of 1902.

LEHIGH VALLEY REORGANIZATION.—The property and franchises of the Lehigh Valley Traction Company have been sold at Allentown, Pa., under an order of the court for $2,000,000, the purchasers being William F. Harrity, George H. Frazier and Harry C. Trexler, comprising the reorganization committee.

TWIN CITY STOCK.—The Twin City Rapid Transit Company has applied to the New York Stock Exchange to list $1,000,000 additional common stock.

OHIO TRACTION COMPANY.—The Ohio Traction Company, with a capital of $20,000,000, half preferred and half common, has listed its securities on the Cincinnati Stock Exchange.

INTERNATIONAL PUMP.—The International Steam Pump Company has applied to the stock exchange to list $1,000,000 additional 10-year debenture 6 per cent bonds of 1913.

General News of the Week

The Telephone.

DENVER, COL.—The Union Pacific is planning to install the new telephone system for the handling of trains, which was experimented with two years ago and is now in operation over small sections of the line. The system will be constructed over the entire road.

STAMFORD, CONN.—The American Telegraph & Telephone Company has presented a petition to the City Council for the laying of a conduit through the main street of the city.

HARTFORD, CONN.—Telephone service will be cheaper in Hartford, New Haven and Bridgeport on and after the first of January next, in Waterbury after July 1, 1905, and in other cities after October 1, 1905, according to the reduced rate schedule of the Southern New England Telephone Company given out by President Morris F. Tyler. The changes which affect Connecticut's three cities are as follows: The single-line business service will be reduced from $100 to $84; the party line business service will be reduced from $72 to $60; the party line residence service will be reduced from $36 to $30; a new service for $36 will be given, having but two residences on a circuit, with what is known as "selective calling," so that the bell will ring only when the party is wanted. New measured service rates will be introduced as follows: On party lines: 400 calls for $25 instead of 380 as at present, extra calls 4 cents; 800 calls for $36, extra calls 4 cents; 1,200 calls for $42, extra calls 3 cents; on single circuit, 1,000 calls for $50, instead of 760 calls, as at present, extra calls 4 cents; 1,500 calls for $60, extra calls 3½ cents. Unless expressly limited to residences, all measured service rates are offered for business and residences alike. In Danbury, Meriden, Middletown, New Britain, New London, Norwich, South Norwalk and Stamford, substantial reductions on all kinds of service go into effect October 1, 1905.

TWIN FALLS, IDAHO.—The People's Telephone Company, which was recently organized here, has applied to the City Council for a franchise.

BOISE, IDAHO.—The Idaho Independent Telephone Company has purchased a lot upon which it is proposed to erect a modern building for the central office.

HARVARD, ILL.—The Chicago Telephone Company has purchased the country lines of the Harvard Telephone Company.

MONMOUTH, ILL.—The Galesburg Union Telephone Company will in the near future build in Galesburg a fine exchange building costing $10,000.

ABINGDON, ILL.—A franchise has been granted to the Mutual Union Telephone Company, of Abingdon, to build a telephone system between Abingdon and St. Augustine.

MONROE, ILL.—The Killbuck Telephone Company, of Monroe, has been incorporated with a capital stock of $1500. The incorporators are: A. Thompson, E. A. Foster and G. A. Sauber.

ODIN, ILL.—The Odin & Sandoval Township Telephone Company has been incorporated with a capital stock of $600. The incorporators are A. J. McClelland, George Ross and R. R. Glines.

HACKBERRY, ILL.—The Hackberry Mutual Telephone Company was incorporated June 19 with a capital stock of $1200. The incorporators are William McMeese, James E. McKittrick and J. B. Tripp.

WATSEKA, ILL.—The Board of Supervisors has granted a franchise for a new telephone line to be constructed on the Hoopeston road. The company is called the Southern Limited Telephone Company. The officers are: President, T. J. Downey; secretary, Frank A. Pruitt; treasurer, George Lockhart; manager, Jno. S. Lockhart.

TERRE HAUTE, IND.—The Central Union Telephone Company will ask the City Council for permission to install a conduit system in Terre Haute. It will offer the city the right to use one duct in each conduit for police and fire alarm telegraph.

LOGANSPORT, IND.—A district meeting of the chief operators of the Central Union telephone exchanges of the first district of Indiana was held in this city last week for the purpose of conferring with E. J. Roche, of South Bend, service inspector for the district. Arrangements were also made for the annual outing of the operators, which will be held at Lake Maxinkukee. The chief topic discussed was: "How Best to Improve the Various Toll Lines."

FORT WAYNE, IND.—Representatives of the Independent Telephone Companies of the northeastern part of the State held a meeting in this city last week and discussed a plan of invasion for the lost territory, the acquiring of franchises, etc. The matter was left in the hands of a committee headed by Mr. W. L. Moelling, of this city. Judge R. D. Taylor was present and rendered an opinion to the effect that the contracts affecting the toll-line service which the independents had with the United Telephone Company are good and enforcable. The committee will have a meeting at the close of the Chicago convention.

CEDAR RAPIDS, IOWA.—A new exchange is to be installed by the Walker Telephone Company.

SOMERS, IOWA.—The Somers Telephone Company has been incorporated with $5,000 capital.

MUSCATINE, IOWA.—Articles of incorporation have been filed by the Massena Independent Telephone Company of this city with a capital of $10,000. George J. Austey and others are the incorporators.

WATERLOO, IOWA.—Articles of incorporation have been filed with the Secretary of State by the Corn Belt Telephone Company with the principal office at Waterloo. The capital is $300,000. A. T. Averill is president, C. W. Chapman, vice-president; S. S. Lichty, secretary, and W. P. Frech, treasurer.

HAZLETON, KAN.—The Barber Telephone Company is constructing a telephone system which will commence operation with two boards of 100 drops each. The same company intends to build lines to Medicine Lodge and Kiowa this fall. C. F. Ware, Crisfield, Kan., is secretary.

GRAND RAPIDS, MICH.—The Wood County Mutual Telephone Company has been formed with a capital of $10,000.

ALPENA, MICH.—The Alpena Mutual Telephone Company has leased for five years all telephone property belonging to the Michigan State Company in this locality, including suburban lines, cables, etc. The Mutual company will complete lines to Spruce, Hubbard Lake and other towns.

INTERNATIONAL FALLS, MINN.—The International Telephone Company has been formed; capital $50,000. The incorporators are E. W. Backus, W. F. Brooks and others.

RICE, MINN.—Residents of this place will install telephone connections with the long distance lines of the St. Cloud exchange. The local company will be known as the Apollo Telephone Company.

INDEPENDENCE, MO.—The Independence Home Telephone Company has increased its capital stock from $30,000 to $60,000.

ST. LOUIS, MO.—St. Louis is to enlarge its municipal telephone plant, which, it is claimed, will effect a large saving to the city. The city rents 170 telephones used in the City Hall and other institutions.

CLINTON, MO.—Stockholders of the Mutual United Telephone Company, of Clinton, have elected the following directors and officers for the ensuing year: W. F. Hall, president; G. W. Schweer, of Windsor, vice president; Dr. S. T. Neill, business manager; Geo. R. Lingle, secretary and treasurer.

ST. LOUIS, MO.—The Suburban Telephone Co., recently organized and operating in St. Louis County from Clayton, has been purchased by a syndicate formed by the Mississippi Valley Trust Co. The concern will be reorganized and conducted as an independent company. Plans of the syndicate include raising the capital stock from $100,000 to $500,000. The system which operates within a radius of about five or six miles of Clayton, will extend its lines so as to take in the entire county. New equipment will be added to the plant and improvements will be made in all departments. The intention is to equip the system so as to give an up-to-date service and reach residents in all parts of St. Louis County. The deal was closed June 20 through James D. Housman, the original promoter and a large stockholder of the company. The purchasing company includes several of the large stockholders of the Kinloch Telephone Co., and several of those of the Suburban Co. There is a working agreement between the Suburban and the Kinloch companies. This, it is said, will be continued, though the county company will be independent.

HAMMONTON, N. J.—The Hammonton Telephone & Telegraph Company has been incorporated with a capital of $125,000. The incorporators are Andrew J. Rider, Samuel Anderson and others.

FREEHOLD, N. J.—George H. Atkinson, as trustee, sold at public vendue all the rights, title and interest in the Red Bank Telephone Company and the Freehold Telephone & Telegraph Company. The Red Bank plant was purchased by Henry C. McLean, of Red Bank, for $2,550. The Freehold Telephone & Telegraph Company plant was purchased by George W. Eggert, of Perth Amboy, for $1,550.

NEW YORK, N. Y.—The West Lakeside Telephone Company of this city has been organized with a capital of $15,000. The incorporators are Charles Long, William Lockwood and others.

NEW YORK, N. Y.—The Rock Rift, Cannonsville & Granton Telephone Company has been organized with a capital of $260. The incorporators are D. C. Gregory, L. H. Owjes and others.

ALBANY, N. Y.—The Lake Champlain Telephone & Telegraph Company has been incorporated to operate from Eagle Bridge through Rensselaer, Washington and Essex counties, New York State and Bennington, Rutland and Addison Counties, Vermont. The capital stock is $250,000. The directors are Henry E. Hawley, Albany; F. W. Story, Boston; O. O. Dennis, Whitehall; E. D. Raymond, Fairhaven, Vt.

AMSTERDAM, N. Y.—There is a telephone rate war on in Amsterdam between the Hudson River Telephone Company and the Automatic, an independent company. The monthly rates have already been cut down by the Automatic Company to a trifle over $1 a month. The Bell people are offering to install telephones for six months free. Both companies have canvassers at work in the city and the suburban towns, and in the latter places rates have been cut to $1.25 a month where the Bell people have been charging $4.50. The Bell company is now meeting the cut rate.

WAYNESFIELD, OHIO.—The Auglaize Telephone Company has increased its capital stock from $15,000 to $25,000.

YOUNGSTOWN, OHIO.—The Union Works of the Carnegie Steel Company have just had installed an entirely new telephone exchange system.

MORGANSVILLE, OHIO.—The Morganville Telephone Company has been organized with a capital of $5,000. The incorporators are Morgansville men.

ROCK CREEK, OHIO.—The Citizens' Telephone Company has been formed by C. W. Harrington, R. W. Covell, C. E. Andrews, G. H. Ray, E. K. Mills. Capital, $4,000.

SNYDER, OKLA.—The Snyder Telephone Company, of Snyder, filed letters of incorporation June 5. The incorporators are J. Helen, J. H. Carmack, Fred Switzer and J. V. McClintic. The capital is $5,000.

MT. STERLING, OHIO.—The Home Telephone Company has been organized here. The capital stock of the new concern is $15,000. The incorporators are: W. H. Alkire, N. A. Riggin, G. M. Fisher, H. L. Cook, T. S. Alkire and T. P. Sylvan.

TOLEDO, OHIO.—A syndicate of Toledo capitalists has purchased a one-third interest in the Cuyahoga Telephone Company, of Cleveland, Ohio. Messrs. Brailey, Bell and Secor are members of the syndicate and are well-known in the independent telephone field.

PHILADELPHIA, PA.—The business of the Philadelphia Bell Telephone Company has increased very rapidly in the last year and a half. On January 1, 1904, the stations in service numbered 67,268. The gain for the year was 15,229, so that the number of stations in use on January 1, 1905, was 82,497. On June 1, 1905, the number of stations in service stood at 94,533, making a gain for the last five months of 12,036 and placing the system at a very high point as regards numbers compared with other systems the world over.

SALT LAKE CITY, UTAH.—The Independent Telephone Company is constructing a line to Fort Douglas.

COALVILLE, UTAH.—The County Commissioners have granted a franchise to the Utah Independent Telephone Company.

SALT LAKE CITY, UTAH.—The Independent Telephone Companies of this city and Los Angeles are completing arrangements for the construction of a line to connecte the two cities.

SPOKANE, WASH.—An effort is being made to effect the consolidation of all the independent telephone companies in Washington and other Pacific Coast States. Attorney A. L. Black, of Bellingham, represents a number of the independent telephone interests in the proposed incorporation.

RICHLAND CENTER, WIS.—The Independent Consolidated Company is in the hands of a receiver.

Electric Light and Power.

ENSLEY, ALA.—The Mayor and Board of Aldermen have authorized the lighting committee to investigate the question of constructing an electric light plant, procure plans and specifications and report back to Council July 6.

JACKSON, ALA.—The lighting plant at this place, which was only completed December 15, 1904, already requires extension. It is proposed to add an overshot waterwheel. Geo. P. Brockman is electrical engineer and superintendent.

LOYALTON, CAL.—The Loyalton Electric Light Company is extending its service to Beckwith, 17 miles from here, across the Sierra Valley. The town of Beckwith will be lighted by electricity in the near future.

SOUTH NORWALK, CONN.—On June 15 the Board of Electrical Commissioners awarded contracts for an enlargement of the city electrical station. The proposal of the Diesel Engine Company for a gas engine was accepted, the amount involved being $16,000. The contract for electrical equipment was awarded to the Fort Wayne Electric Works.

WYOMING, DEL.—Alex. Daly, representing Philadelphia capitalists, has presented to the citizens of Wyoming and Camden, Del., a proposition to install a water and light plant to supply both towns.

COVINGTON, GA.—It has been decided by the City Council to rebuild at once the electric lighting plant which was recently demolished by a boiler explosion.

GRANITE CITY, ILL.—This city is in need of a good up-to-date electrical plant for street and commercial lighting. The place has a population of about 8000, and is growing rapidly. Mr. Alvin Morefield can give information to any one interested.

QUINCY, ILL.—The Quincy Gas & Electric Company has changed its name to Quincy Gas, Electric & Heating Company. The number of directors has been increased from five to seven, and the capital stock increased from $600,000 to $2,000,000.

HARRISBURG, ILL.—John W. Shaw has been appointed receiver for the Harrisburg Water, Light & Power Company by Judge W. N. Butler, upon application of the American Trust & Savings Bank of Chicago, to which the property of the company was transferred in trust recently. The plant has been doing a good business, but has fallen behind with its interest payments and other obligations.

GREENFIELD, IND.—The Water and Light Commissioners are in the market for a 350-hp. engine and two new boilers for the electric light plant.

GREENFIELD, IND.—Municipal ownership has not proven a success in this city. The corporation owns and operates the water-works and electric light plants. Over $17,000 is now required for making repairs and improvements at the electric light plant, but the city has no money to do it and is in debt up to the constitutional limit. An expert examined the plant and reports that a new 350-hp. engine and two new boilers were necessary, and the cost would be $17,500. A sale of the plant is advocated.

FORT DODGE, IA.—The City Council has appointed a committee to investigate the construction of a gas and electric light plant, to be owned and operated by the city.

CRESTON, IA.—A franchise for an electric light plant has been granted to a new company, of which J. C. Sullivan is president and J. W. Reynolds secretary. The company is now arranging to purchase equipment for a plant to cost about $40,000.

CAMPBELLSVILLE, KY.—J. L. Atkinson, Pres. Campbellsville Lighting Company, says bids for constructing an electric light plant, to cost $4000, will be received about Aug. 15 by the Campbellsville Lighting Company. B. S. Kincort, Lebanon, Ky., is the engineer.

SHREVEPORT, LA.—Mayor Querbes and the lighting committee have recommended that Council enter into a contract with the Shreveport Gas, Electric Light & Power Company for lighting the city for a period of 6 years.

NEW ORLEANS, LA.—The Algiers Railway & Lighting Company is to construct a power plant at a cost of $200,000.

WATERVILLE, ME.—At a meeting of the stockholders of the Kennebec Water Power Company, the following officers were elected: President, Charles A. Dean; treasurer, W. H. K. Abbott; clerk, A. M. Kennison.

GLENDALE, MASS.—The Monument Mills Company, of Housatonic, is making plans to develop the water power at Glendale. Barnes & Farnham, of Pittsfield, are making surveys.

BALTIMORE, MD.—At the annual meeting of the stockholders of the Mount Washington Electric Light & Power Company, the following officials were elected for the ensuing year: President and general manager, Thomas W. Offut; vice-president, Alten S. Miller; secretary and treasurer, Harry J. McIntyre; directors, Thomas W. Offut, Alten S. Miller, S. Davies Warfield, Walter R. Townsend and Richard A. Bevan. The company is expending about $100,000 for the power house and new machinery, and will have the new plant in operation by Sept. 1.

HOLYOKE, MASS.—Plans have been completed for the new power plant of the Holyoke Water Power Company, on the west bank of Connecticut River. They call for the construction of a new canal, from which water will be conveyed to a 7000-hp power plant.

MISSOULA, MONT.—Missoula Light & Water Company will enlarge and improve its plant at an estimated expenditure of $30,000.

LIVINGSTON, MONT.—An electric power plant, to cost about $60,000, will be established here shortly by Lewiston capitalists. John L. Bright is at the head of the project.

MISSOULA, MONT.—The Missoula Light & Water Company has ordered from the Westinghouse Machine Company a 500-kw, three-phase, 60-cycle, 2200-volt Westinghouse-Parsons steam turbine. Other contracts for motor-driven exciter sets, switchboard material and surface condensing outfit have also been placed, the whole aggregating about $30,000.

OMAHA, NEB.—An ordinance is before the Council providing for laying of electric wires underground within the district bounded by P street, 23d Street, on east, Q street on south, and 26th street on west.

NEWARK, N. J.—The new owners of the New Light, Heat & Power Company will take charge July 1. This plant was recently sold to Messrs. Rigby, Mandeville and Mathews by the Gas & Electric Development Company, of Philadelphia, Pa. Extensive improvements are contemplated.

ANDOVER, N. Y.—The Andover Electric Power & Light Company, of Andover, has been incorporated with a capital of $10,000, by R. A. Stout, A. B. Richardson and J. H. Backus, all of Andover.

YOUNGSTOWN, OHIO.—All bids opened on June 19, for constructing an electric light plant for the water-works pumping station, has been rejected, and new bids will be received July 15.

NEW BREMEN, OHIO.—The village of New Bremen has instituted ouster proceedings against the New Bremen Electric Light Company, claiming that the company has no legal right to the use of the streets and alleys of the town, inasmuch as the original ordinance granting the franchise did not contain the .words "heirs, successors and assigns." The franchise expired two months ago. The town wants to buy the plant.

TOLEDO, OHIO.—The May statement of Toledo Railways & Light showed an increase in gross of 8.3 per cent and an increase in net of 12.7 per cent. Earnings have been running considerably ahead of last year so far this fiscal year, so that for the four months ending May 31 there has been an increase of 8.18 per cent. in gross earnings and an increase of 17½ per cent in net, while the surplus after charges has increased 55½ per cent.

CAMBRIDGE SPRINGS, PA.—The Cambridge Springs Electric Light Company has been incorporated with a capital of $20,000, by A. H. Matteson, Chas. W. Jones and others, all of Cambridge Springs.

TAMAQUA, PA.—The Tamaqua Heat, Light & Power Company has purchased a site for a new plant.

MONTROSE, S. D.—Donohue & Williams, of Montrose, write that their electric plant is about completed, but they desire electric fixture catalogues.

MURFREESBORO, TENN.—The City Council has granted the City Gas & Electric Light Company a franchise and a 10-year contract.

LAFOLLETTE, TENN.—The Lafollette Water, Light & Telephone Company has been organized with a capital of $150,000. The directors are: W. C. Knight, St. Louis, Mo.; F. A. Joss, Indianapolis, Ind., and T. C. Whalen, of Indianapolis, Ind.

DENTON, TEX.—The city has purchased the plant of the Denton Water, Light & Power Company, and will take possession on July 1.

JOHNSON, VA.—There has been talk of installing the electric plant at Ithiel Falls and it is understood that the town has purchased the water power of Rev. I. T. Johnson, and that the plant is to be established there.

TOLUCA, MEX.—The Toluca Electric Light & Power Company will establish an electric power plant at Temascaltepec, on the Rio Verde. It is proposed to develop about 3000 hp, which will be transmitted to the towns of that region. R. J. M. Danley is general manager and chief engineer, with headquarters at Toluca.

FORT WILLIAM, ONT.—Extensive power development at Fort William, Ont., is contemplated by a company having a capital of $2,000,000. The name assumed is the Kakabeka Power Company. The incorporators are: H. S. Holt, president of the Montreal Light, Heat & Power Company; Chas. R. Hosmer, director of the Canadian Pacific Railway; F. W. Thompson, manager of the Ogilvie Flour Mills Company; W. Norton and F. H. Phippen, of Montreal.

The Electric Railway.

LOS ANGELES, CAL.—The Los Angeles Pacific Railroad Company is reported to have purchased a site for a new power house and sub-station here.

LOS ANGELES, CAL.—Surveyors are at work running the lines for an electric railway from San Bernardino to the summit of the mountains, directly north of that city, a distance of about 20 miles.

INDIANAPOLIS, IND.—Hundreds of families of this city have gone out camping for the summer. Eagle Creek, Sugar Creek, Flat Rock, Blue River, White River, Jewett Lake and Spring Lake are lined with campers because each are crossed or touched at convenient places by interurban lines. It is estimated that between 1,000 and 2,000 people will live in camps this summer, the men going back and forth on the interurban lines.

BOSTON, MASS.—The Massachusetts Electric Company is sending over its extensive system of nearly 900 miles a model car bearing a great poster which reads "Boston & Northern and Old Colony Street Railway advertising car." This car is heavily laden with interesting literature which gives descriptions of the seashore resorts, places of historic interest and rural scenery to be reached by the system. This car has already run through the principal cities and towns on the system and over 500,000 booklets have been placed in the hands of the people.

ST. JOHN, N. B.—The annual statement of the St. John street railway shows that the net profit, during the past year, after providing for the interest on the bonds and all other charges, is $52,034, out of which two half yearly dividends have been declared, amounting to $44,626, leaving a balance of $7,407.

ALBANY, N. Y.—The Buffalo, Lockport & Rochester Railway Company, a consolidation of the Albion Electric Railway, the Albion & Rochester Railway and the Albion & Lockport Railway, has been incorporated with a capital stock of $590,000. The directors are F. B. Griffith, Jr., Charles B. Hill, Buffalo; Lorenzo Burrows, George B. Church, Albion; R. A. Adams, Rochester.

NEWARK, N. J.—Thomas N. McCarter, president of the Public Service Corporation, has announced that his corporation has determined on the construction and operation, through the agency of a subsidiary company, shortly to be formed, of a modern high-speed electric road from this city to New York. Thirty minutes from the center of Newark to the business part of New York City is promised.

ALLENTOWN, PA.—The franchise and properties of the Lehigh Valley Traction Company were sold in foreclosure here a few days ago. The price paid was $2,000,000, the purchaser being William F. Harrity, acting for the reorganization committee.

BLOOMSBURG, PA.—The contract for the grading and general construction of the New Millville-Bloomsburg trolley line has been awarded to Thomas H. Reagan & Company, of Philadelphia. F. W. Darlington will be superintendent of construction.

JEANNETTE, PA.—Officials of the Jeannette-West Newton trolley line have signed a contract with the New England Construction Company to build the road. The line will be about 14 miles long, and will run through Adamsburg, Edna, Madison and Herminie. In Jeannette it will connect with the Pittsburg-Greensburg line.

NEW CASTLE, PA.—A new interurban trolley line direct from this city to Sharon may be one of the first results of the coming merger of the Pennsylvania & Mahoning Valley and the New Castle & Sharon Companies. A direct line, it is said, will be built to Sharon by way of the Shenango Valley through Pulaski, West Middlesex and Wheatland.

WAYNESBORO, PA.—The Winchester & Washington City Railway Company has purchased from the estate of former Governor Lowndes, Cumberland, and David Sloan, of Lonaconing, their water power on the Shenandoah river, 4 miles southeast of Charlestown, for $10,000. The company has an engineer on the premises, who is making surveys. The power will be developed. It is stated that the company will build a trolley line from Harper's Ferry to Winchester by way of Charlestown and Berryville. A line is also to be built from Berryville to Bluemont, Va., and probably from that point to Washington. The water power is said to be capable of developing 2,000 hp. Winchester, Berryville and Philadelphia men are the promoters. N. Wilson Davis, Harrisonburg, has been elected the resident engineer.

MANITOWOC, WIS.—The Fox River Railway Company, of which Isaac Smith, of New York, is consulting engineer, has had its survey for location completed. The line as surveyed is 65 miles long.

KINGSTON, ONT.—The civic authorities of the city of Kingston, Ont., have given the bondholders of the electric street railway notice that the street railway generators, in the city's electric power house, must be removed before July 1, as the space now occupied by these generators is required for the extension of the lighting system. This means that the city has no intention of further supplying power to the street railway, and it also means that there will be no cars operated in the city during the summer at least, as a power plant could not be erected in less than three months.

OTTAWA, ONT.—In the railway committee of the Canadian Senate, the Ottawa Electrical Company's bill to increase its capital and providing authority to amalgamate with other existing electric companies, was passed on June 14. When this bill was before the Commons, the city of Ottawa objected to the company being allowed to establish a monopoly in the electric lighting business of the Canadian capital. Since then, however, the city has bought out the Consumers' Electric Company, the plant of which is to be owned and operated by the city as a means of ensuring competition to the public. The Ottawa Electric Company has held out a sop to the city by offering the municipality a seat on the company's board of directors, and that after a six per cent dividend has been declared, all surplus earnings shall be devoted to the reduction of the rates.

New Industrial Companies.

THE CRESCENT ELECTRICAL & MANUFACTURING COMPANY, of Valparaiso, Ind, has been incorporated with a capital stock of $20,000. The directors are James H. McGill, Harry W. Harrold and Leslie R. Skinner.

THE CHARLES A. THOMPSON COMPANY, of New York, N. Y., has been incorporated to manufacture electrical machinery, etc., with a capital stock of $25,000. The incorporators are Charles A. Thompson, Brooklyn; Rudolph Miehling, New York; James Shaw, Brooklyn.

THE SCOTT ARC LAMP COMPANY, of Portland, Me., has been organized for the purpose of manufacturing arc and incandescent lamps, and for other purposes, with a capital stock of $1,000,000. The officers are: President, H. E. Mason, Portland; treasurer, James J. Hernan, Portland.

THE AITON MACHINE COMPANY has been incorporated under the laws of New Jersey for the manufacture and sale of machinery covered by Mr. Thos. A. Aiton's patents for all classes of wire insulation, cabling and rubber machinery, and is now established in connection with Marine Engine & Machine Company, at Harrison, N. J. The factory facilities provide for prompt execution of the largest as well as the smallest orders. The company has a large foundry with capacity and modern facilities for producing high-grade castings up to the largest sizes, and an ample railroad siding and wharf on tide water insure prompt and economical shipments. The officials of the Aiton Machine Company are as follows: Mr. Gardiner C. Sims, president; Mr. Thos. A. Aiton, vice-president; Mr. Arthur S. Beves, secretary and treasurer. Mr. Aiton's business was formerly conducted in conjunction with the Chase Machine Company, Cleveland, Ohio.

Legal.

NEGLIGENT TELEPHONE CONSTRUCTION.—The Kansas City, Mo., Court of Appeals, in the suit of Smith vs. Miss. & Kan. Telephone Company, affirming a decision for the plaintiff, holds that: 1. The proximate cause of plaintiff's injury was the negligence of defendant telephone company in setting a guy pole for the purpose of bracing another pole loaded with telephone wires and keeping them from contact with electric light wires carrying a high voltage of electricity. 2. Where an electric lineman was injured by the negligence of a telephone company in setting a guy pole, defendant was not relieved from liability because of the fact that the defectiveness of the construction only manifested itself after a severe but not unprecedented storm, defendant being bound to make its construction sufficient to stand storms of ordinary or normal severity. 3. Where the parting of electric primary wires carrying a heavy voltage was the direct result of defendant's negligence and plaintiff, a lineman, was violently shocked and injured, because of such negligence, while at work on a telephone pole, it was no defence that some other person negligently wrapped the ends of the broken wires around the pole, and thereby facilitated the forming of a short circuit on the pole on which plaintiff was working. 4. Where an electric lineman, while working on a telephone pole, treated an electric light wire as charged, and the closing of the circuit by his body coming in contact with the wire was purely accidental and caused by slipping of his foot, he was not guilty of contributory negligence in failing to test the light wire, or in failing to wear rubber gloves, it appearing that there was no danger in handling live wires when the body was not in a position to connect them with other charged wires or with the ground.

Obituary.

MR. JAMES GAMBLE.—Mr. James Gamble, formerly Oakland (Cal.) manager of the Western Union Telegraph Company, died recently at Santa Barbara, where he had gone for his health. He is survived by two daughters, Mrs. Walter Ellis and Miss Mary Gamble, and three sons, James, Jr., Fritz and Leland. The latter was formerly a well-known Coast newspaper writer, but in recent years has been connected with Eastern mining journals.

MR. T. C. WALES, JR.—We regret to note that Mr. Thomas C. Wales, Jr., chief engineer of the New England Telephone & Telegraph Company, died this week at the Boothby Hospital, Boston. He was brought from Rutland, Vt., last Saturday, to be operated on for appendicitis, and did not successfully stand the shock. The operation was performed at the hospital by Dr. William M. Conant and Dr. Ernest D. Burden, and it was found after the operation that Mr. Wales could not live so advanced was the trouble, yet everything possible was done to save him. Mr. Wales was a son-in-law of R. H. White. When he was stricken in Rutland Mrs. Wales was summoned, and it was decided to bring him to Boston to be operated on. A special train was secured and the trip to Boston was made in record-breaking time. Mr. Wales's body was taken to his home at Chestnut Hill, Newton.

W. W. DONALDSON.—We regret the death of Mr. William W. Donaldson, which occurred at Elk Ridge, Md., on June 12. Mr. Donaldson was born June 16, 1863, at Baltimore, and received his primary education at George Carey's School, which he left at the age of 18 to enter Princeton. He remained at Princeton one year and a half, and left to take up special courses in chemistry and physics in Baltimore. He entered on storage battery work in February, 1884, and was connected in turn with the Storage Battery Company, of Baltimore, the Eastern Electric Company, and the Donaldson-Macree Storage Battery Company, of which latter he was president for three years, being a co-inventor with Mr. Macree of the type of battery manufactured by this company. In 1899 he became the engineer of the Automobile Manufacturing Company of Baltimore, and in 1901 accepted the position of electrical engineer with the Gould Storage Battery Company of New York, which he occupied at the time of his death.

Personal.

MR. F. C. TIDHAM, of Dallas, Tex., has been appointed general manager of the Oklahoma City Gas & Electric Company.

MR. W. VON PHUL has resigned as general superintendent of the electrical division of the Cincinnati Gas & Electric Co.

WM. STEWART WILDER will be general manager, as well as vice-president of the Northern Westchester Lighting Company, with offices at Ossining.

PROF. CHAS. P. MATTHEWS has been elected as head of the department of electrical engineering at Purdue University, to succeed Prof. W. E. Goldsborough.

MR. T. K. JACKSON, recently connected with gas and electric interests of Oklahoma City, Okla., has joined the forces of the Byllesby Engineering Company, of Chicago.

MR. J. H. WHITE, formerly superintendent of the Alton, Ill., Gas & Electric Company, has been made general manager of the Winona, Minn., Railway & Light Company.

MR. ALEX. H. KIRKWOOD, cashier of the Cleveland Telephone Company, has been elected treasurer of that company to fill the vacancy created by the death of J. P. McKinstry.

MR. JOHN P. HOLLAND, inventor of the submarine boat, and a lecturer on applied mechanics at Manhattan College, has received from that college the honorary degree of Master of Science.

DR. ALBERTO PIRELLI, of Milan, Italy, who was one of the visiting electrical engineers last year, expects to be again in this country during July, on behalf of the well-known Italian cable manufacturing firm of which he is a member.

MR. WALTER K. GANONG has received the appointment of acting professor in the department of electrical engineering at the University of Maine. Mr. Howard D. Carpenter will fill the vacancy in the department caused by Prof. Ganong's promotion.

MR. J. H. EVANS has been appointed secretary of the Kings County Electric Light & Power Company and of the Brooklyn Edison Company, to succeed Mr. W. W. Freeman. Mr. Evans has been auditor of the Edison Company since 1902.

MR. W. F. WELLS, the efficient superintendent of the big Waterside station of the New York Edison Company, and formerly with the Brooklyn Edison Company, now returns to the latter corporation, having been made its general superintendent during the present week.

MR. G. E. SKOG, who was connected with the Westinghouse Elec. & Mfg. Company for a number of years, and left for Europe a few months ago, has accepted the position of Superintendent of Construction with the Allmanna Svenska Electric Company, the largest electrical company of Scandinavia. Mr. Skog has headquarters in Westeras, Sweden.

MR. WYNNE MEREDITH, of Cory, Allen & Meredith, San Francisco, has gone to Chicago on a business trip. He recently completed the engineering of the Vancouver Power Company's electric power transmission plant on Burrard Inlet, B. C. A 13,000-ft. tunnel through solid rock and a 2800-ft. span across an inlet are among the special features of this 16-mile, 20,000-volt transmission.

MR. N. F. BRADY, treasurer of the New York Edison Company, finding that several old fire horses after doing good service were to be sold cheap for more hard work or for delicatessen, has gathered them in at the sale and given them positions on one of the farms up the State, where they will now literally live in clover. This is a generous plan that might well be developed and persisted in.

MR. P. TORCHIO, a biographical sketch of whom appeared recently in our series devoted to electrical engineers, has now been made chief electrical engineer of the New York Edison Company, a promotion well deserved by conspicuous merit and ability. Mr. and Mrs. Torchio are sailing this week for their native land, Italy, and will spend two or three months there, more particularly in the north and the vicinity of Milan.

MR. DELANCEY RANKINE.—It is announced that Mr. DeLancey Rankine has been made third vice-president of the Niagara Falls Power Company and its allied companies, to succeed the late Mr. George W. Davenport. For seven years past Mr. Rankine has been secretary and treasurer of the Cataract Power & Conduit Company, Buffalo, and secretary-treasurer and general manager of the Tonawanda Power Company and of the Suburban Power Company.

MR. W. W. FREEMAN, secretary and treasurer of the Brooklyn Edison Company, has been promoted as vice-president and general manager, in the place of the late Mr. E. A. Leslie, and has assumed the new duties. He assumes similar duties with the Kings County Electric Light & Power Company. Mr. Freeman has had a steady and rapid rise in the Edison Company, which he entered as a stenographer when it was organized in 1889. He also takes Mr. Leslie's place as a director and treasurer of the Testing Laboratories of this city.

MR. EUGENE LENTILHON, C. E., for the past several years a contracting engineer in New York City, has become associated with J. G. White & Company, and is now on his way to Chili on a mission covering the investigation of a number of important engineering projects. Mr. Lentilhon is a graduate of the Sheffield Scientific School, Yale University, and, for several years following his graduation, was in the service of the Dock Department in New York City. His most important work in this direction was his supervision as assistant engineer of improvements and repairs on the North River from the Battery to 14th St. In 1897 Mr. Lentilhon resigned from the Dock Department to engage in business as a contracting engineer. Among the principal contracts completed by him were the construction of the Hudson Park, New York City; the erection of two buildings at the New York Navy Yard; the removal of the reservoir from the site on Fifth Ave., between 40th and 42d Sts., New York City, and the building of the foundations for the New York Public Library.

MR. G. R. WADSWORTH, who has recently joined the staff of J. G. White & Company as assistant to the construction manager, was born in 1875, and in 1898 graduated from the Massachusetts Institute of Technology in civil engineering. He entered the employ of the New York Central Railroad at Albany, being assigned to the office of division engineer, in which he worked in various capacities, ultimately being appointed assistant engineer. In 1901 he was transferred to the general offices in New York on special work under the engineer of track. Shortly afterwards he was made resident engineer of the middle district at Albany in charge of construction work. In 1902 Mr. Wadsworth was appointed designing engineer of the company, with headquarters at the Grand Central Station. Here he had the supervision of plans and estimates for bridge masonry, culverts, piers, bulkheads and yard and shop layouts. In 1903, he was placed on the New York Terminal improvement as assistant engineer, having charge of the construction of the "Port Morris Branch Depression" in the Bronx, the "Marble Hill Cut-off" in Upper Manhattan and general improvements in four-tracking. Early in 1905 Mr. Wadsworth was appointed resident engineer of the Hudson district, in charge of contract work connected with the terminal improvements from Mott Haven to Croton. Since graduation Mr. Wadsworth has been continuously in the employ of the New York Central, and his rapid promotion has given him an unusually wide experience for a man of his age.

MR. HAROLD ULMER WALLACE has resigned as chief engineer of the Illinois Central Railroad to accept the position of third vice-president with J. G. White & Company, Inc. Mr. Wallace was born in 1872 and graduated from the Chicago Manual Training School in 1892, after which he took a special course in civil engineering at Purdue University. He entered the service of the Illinois Central R. R. in 1894 as assistant engineer, and had charge of the construction work and of new concrete and masonry work. In 1896 he was appointed resident engineer of the Lake Front improvement work at Chicago, which was completed in eight months and cost $1,000,000. This work included the depression and reconstruction of twenty miles of main line and yard track; the building of a masonry retaining wall, one mile long, and of a sea wall, 8,000 feet long; the placing of 2,000,000 yards of filling; and the erection of an underground station and three street viaducts. From 1896 to 1900 he was roadmaster of the Chicago Terminals and the Louisville Division. During the two years of his assignment to the Louisville Division, its main line was entirely reconstructed. From 1900 to 1902 he was superintendent of the Freeport & Louisville Division. Since 1902 Mr. Wallace has been chief engineer of the Illinois Central Railroad, and has had charge of the maintenance of way, bridges and buildings and reconstruction work, including the building and rebuilding of yards, double tracking and grade reductions. He has also directed the construction of elevators and wharves at New Orleans and a ten-story office building at Chicago. Mr. Wallace will direct the management of the construction department of the J. G. White Company, from the main offices of the company, 43 Exchange Place, New York.

Trade Publications.

ICE CONDENSER PIPES.—The Chicago Pneumatic Tool Company has given out some interesting and valuable data as to best methods of scaling condenser pipes in refrigeration plants by the aid of pneumatic hammers.

FAN MOTORS.—Booklet 41-F of the F. Bissell Company, Toledo, Ohio, is devoted to fan motors. Desk and bracket types are illustrated and described and tables of data given covering a large range of these summer conveniences.

IGNITION STORAGE BATTERIES.—The Storage Battery Supply Company, 239 East 27th Street, New York, in a circular describes the "Reliance" and "Reliable" storage batteries for the ignition circuits of gasoline automobiles, motor boats, etc. The two types are handsomely illustrated in colors.

NATIONAL BATTERY COMPANY, of Buffalo, N. Y., is calling the special attention of automobilists to its "National" sparker storage battery outfits for the ignition of the explosive mixture in gasolene motors. A leaflet gives full particulars of the sparkers as put up in either wood or metal cases, with two cells or three cells.

WESTINGHOUSE TURBINES.—Owing to derogatory reports in the newspapers as to steam turbine performance, the Westinghouse Machine Company has issued a very striking list of 70 large Westinghouse turbines in successful use in this country, to which any one interested can have access for information as to their economical results.

THE AITON MACHINE COMPANY has just issued its Bulletin No. 7 showing a No. 7 wire stranding machine, also Bulletin No. 18, showing cable reel winding gear, and would be pleased to furnish any one who would be interested in this type of machinery with copies of the bulletins which it has on file at its offices, 126 Liberty St., New York.

THE SUNBEAM INCANDESCENT LAMP COMPANY has just issued a new bulletin describing and exploiting its complete line of Sunbeam Reflector lamps. These lamps are furnished in 6, 28 and 36 c.p. in all voltages. This bulletin is ready for distribution and a copy will be sent to any one interested upon request either to the above company or to the Western Electric Company. The latter company and its branch houses carry a large stock of Sunbeam lamps, embracing the entire line.

WESTINGHOUSE IN PORTLAND.—The Westinghouse Electric & Mfg. Company has issued in connection with the Lewis & Clark Exposition at Portland, Ore., a very handsome pamphlet with decorated cover, showing Mount Rainier in the background and with two supporters—one an Indian with bow and waving a torch; the other being a figure of peace and progress with a palm branch and the arc light. The contents of the 32 illustrated pages are chiefly a description of the leading Westinghouse products. A complete list is given at the end of the various Westinghouse Companies all over the world.

OIL ENGINES.—The De La Vergne Machine Company, 138th street, New York, has issued an attractive folder devoted to the Hornsby-Akroyd oil engines. It is stated that the amount of fuel per h.p.-hour developed by these engines is about one-eighth of a gallon of kerosene, which may cost from one-half to one cent. These engines are of the single and twin cylinder type, for station work, and are supplied in the portable and semi-portable types for use in running electric generators, refrigerating machines, air compressors and other machinery employed in mining, construction work, on the farm and in the factory.

CABLE POTHEADS.—In a folder recently issued, the Central Electric Company, 207 Jackson Boulevard, Chicago, describes the Candee cable potheads, which are stated to be water and moisture proof and thus capable of preventing the destructive attacks of moisture upon paper-insulated cables. The conductors extending from one end of the pothead or plug are insulated with "Okonite," those from the other end are cotton-covered, and are sealed in a lead sleeve to protect them from dampness. The sleeve is subsequently removed and used for making a permanent joint between the pothead and the lead covering of the cable.

TOOL-ROOM GRINDING.—The Cincinnati Machine Company, Cincinnati, Ohio, has recently issued a well-illustrated "Treatise on Tool-Room Grinding and Grinding Machines," which contains considerable valuable information on the subject of cutter and tool grinding. Part 1 is devoted to the No. 1 cutter and tool grinder, while part 2 is devoted to the No. 2 grinder, which is a machine of new form. This latter machine is a complete universal grinder, and has a range for cutter and tool grinding from the smallest cutters up to face mills 24 in. in diameter. The numerous illustrations show exactly how to handle the work, and the descriptions in connection with them give data on cutter grinding, no matter what machine is used.

SMALL CAPACITY STORAGE BATTERY.—The Electric Storage Battery Company, Philadelphia, has issued Bulletin No. 92, descriptive of its two-plate type chloride accumulator which has been developed to meet the demand for a storage cell of small capacity, occuping a minimum amount of space and of a form readily installed. The positive plate of one cell and the magnetic plate of the adjacent cell are burned to one connecting strap, and the pair is supported by the edges of the two adjacent containing jars. The use of bolt connectors between cells is thus unnecessary; there is no contact to corrode or nuts to loosen, and installation is simplified. Bulletin No. 95 of the same company describes the application of "chloride accumulators" to lighting and power plants as exemplified in the installation at the Youngstown, Ohio, works of the Carnegie Steel Company.

News of the Trade.

REMOVAL.—The Chicago office of the Ball & Wood Company has been removed from the Marquette Building to 401 Fisher Building.

WILLARD STORAGE BATTERY PLANT DESTROYED.—The plant of the Willard Storage Battery Company, Cleveland, O., was destroyed by fire on the morning of June 26.

THE FORT WAYNE ELECTRIC WORKS on June 16 was awarded a contract for the electrical equipment of an extension to the municpal lighting plant of South Norwalk, Conn.

D. M. STEWARD MFG. COMPANY, of Chattanooga, Tenn., has opened a permanent office at 47 Murray Street, New York City, for direct shipment of its lava specialties in this section.

THE DIESEL ENGINE COMPANY on June 16 was awarded a contract for an oil engine to be used in the extension of the municipal electric plant of South Norwalk, Conn. The total amount of the award was $16,000.

THE CRANE COMPANY, Chicago, has moved its general offices and sales departments to its new office building at 519 South Canal St. A branch of the city sales department will be continued at the old address, 10 North Jefferson St., where the company has maintained its general offices since 1864.

E. B. MEYROWITZ, New York, manufacturer of the Vetter current tap, reports business as exceedingly good at present for this ingenious device. This demand is caused, no doubt, by the advent of the fan season. By means of this tap an electric light circuit can be tapped for the operation of a fan motor.

THE COOK POTTERY COMPANY, Trenton, N. J., well known in the porcelain field, has recently gone into the manufacture of electrical porcelain and is making a specialty of tubes. This company states that a guarantee stands behind all its products, and points to the fact of its being established in 1876, having, therefore, an experience of nearly thirty years.

THE STAR PORCELAIN COMPANY, of Trenton, N. J., has found it necessary, owing to its rapidly growing business, to enlarge its extensive plant, and has recently erected an additional building of three stories, and measuring 141 x 30 ft. This new building will be used principally for the manufacture of porcelain tubes, a line which this company has gone into, in addition to its various other porcelain specialties.

MR. CHARLES T. JAEGER, of the Jaeger Miniature Lamp Manufacturing Company, New York, informs us that this company has joined the Association of Licensed Manufacturers of Incandescent Lamps. Mr. Jaeger further states that a provision has been made whereby his customers will be protected on all contracts placed with the Jaeger Miniature Lamp Manufacturing Company at contract prices on or before March 31 last.

THE SANGAMO ELECTRIC COMPANY, Springfield, Ill., had an attractive exhibit at the recent convention of the National Electric Light Association at Denver. It showed several types and sizes of its new Sangamo direct-current wattmeter, which is an improved form of mercury motor-meter. Several of the meters were shown in operation. One of the most interesting features of the display was a shunt of 800 amperes capacity, together with a properly calibrated meter, the combination being suitable for recording total energy, instead of a specially constructed meter being required. The company was represented by Mr. W. W. Low, president of the Electric Appliance Company, of Chicago, who has been for several years the general selling agent for the Sangamo Company. Mr. R. C. Lamphier, superintendent of the Sangamo Electric Company, was also present.

HARVEY HUBBELL, Bridgeport, Conn., manufacturer of machinery, tools and electrical specialties, has incorporated his business, retaining the personal name. It will be a close corporation, and, for all purposes, business will continue as in the past under Mr. Hubbell's management. The object in incorporating was to establish a permanent institution, and also to enable the building up of a stronger business. The present three lines of manufactured goods, machinery, machine screws and electrical specialties, will be continued. The main office will remain at Bridgeport, Conn., with a branch office at 299 Broadway, New York City, under the care of Mr. H. W. Bliven, who is general sales manager. The firm is represented by Thos. C. Grier Company, 128 W. Jackson Boulevard, Chicago, and by The John R. Cole Co., 658 Mission Street, San Francisco, Cal., who carry stock in both places.

THE TEA TRAY COMPANY, of Newark, N. J., maker of incandescent street fixtures, hoods, shades and reflectors, announces the opening of a sales room at its factory, where it shows its well-known Martin specialties. This is the most complete line of incandescent street fixtures, hoods, shades and reflectors on the market, and embraces more than three hundred different articles, including incandescent street fixtures for high-tension circuits, copper hoods with porcelain enameled deflectors (the "don't-rust-out" kind) and hoods and fixtures suitable for all situations and voltages, together with a full assortment of tin shades, porcelain enameled steel shades and mirror reflectors. The Tea Tray Company is the pioneer maker of these goods and its product is standard in quality. Its extensive factory is fully equipped to make special shades and reflectors, as well as regular goods, and it solicits correspondence. Its catalogue No. 15 describes fully these specialties and should be in the hands of every central station manager, contractor and user. The Tea Tray Company's factory is located at Mulberry and Murray Street, Newark, and is quickly reached by the Pennsylvania R. R., South street station, Newark.

CORY, MEREDITH & ALLEN.—The engineering firm of Cory,, Meredith & Allen has recently removed its offices to the Union Trust Building, San Francisco, Cal. The firm engages in expert examinations, advisory reports and construction supervision. The personnel consists of Professor C. L. Cory, the Dean of the College of Mechanics of the University of California, in Berkeley, which college embraces all of the courses in steam, hydraulic and electrical engineering. Mr. Wynne Meredith has been a well-known engineer on the Pacific Coast for the past ten years, and Mr. W. H. Allen has had charge of a number of the electrical power installations on the Pacific Coast during the past five years. The 20,000-hp. plant of the Vancouver Power Company, at Vancouver, B. C., has just been finally completed, the point of particular interest in this plant being the tunnel through the mountains, the length of the tunnel being 13,000 ft. and the section 9 ft. square. The work upon this tunnel has been carried on continuously during the past two years. Upon the examination and report made by the firm this plant was financed, and later it became the consulting engineers, having in charge all the plans and specifications and later supervised the entire work of construction. The plant of the Washoe Power & Development Company, at Reno, Nevada, a 2500-hp. installation, has also just been put in operation. All the engineering work, including the supervision of construction, was done by the firm, which was also consulting engineer for the plant of the Britannica Copper Syndicate at Vancouver Island, also recently completed, which is of interest because of the exceedingly high head, 1935 ft. The steam-driven transmission plant for the Tonopah Mining Company, of Nevada, which is being installed complete by Messrs. C. C. Moore & Co., engineers, of this city, should be completed by September. The firm has had charge of the electric end of this installation, acting as consulting engineers in connection with the general contractors.

W. C. STERLING & SON COMPANY.—The old cedar pole and tie firm of Michigan, W. C. Sterling & Son, which has been doing business in cedar products for a quarter of a century, has incorporated with W. C. Sterling president; W. P. Sterling, vice-president, and W. C. Sterling, Jr., secretary-treasurer. The new company is called the W. C. Sterling & Son Company, and is enlarging its operations and handling cedar on a much larger scale. For a number of years this company has made a gradual and healthy gain in the cedar business and is one of the largest wholesale producers in the country. Twenty-five years ago Commodore W. C. Sterling started out producing small lots of telephone and telegraph poles from the Michigan forests. He took small contracts with the Western Union Telegraph Company, and later extended his business by taking larger contracts and furnishing telephone companies in Michigan and nearby States. He has grown up with the modern electrical business and has furnished poles and ties to nearly every State in the Union east of the Rocky Mountains. Assuming only seventy thousand poles per year that this firm has handled as an average, it means 1,750,000 poles, or with thirty-five poles to the mile, would furnish a pole line 50,000 miles in length, reaching twice around the world. Enough ties have been sold in the last ten years to build over 1,500 miles of railroad, and fence posts enough to fence in thousands of acres of land. There will always be a demand for cedar poles and ties, as there is no wood that can take its place. Cedar poles and ties will outlast any other wood and Michigan cedar is worth at least 25 per cent more than Idaho cedar, Southern cedar, chestnut or cypress. The W. C. Sterling & Son Company has some very large contracts this year with electric and steam railroads for ties. They have purchased all the Maltby Cedar Company stock at Riverhouge, Pinconning and other points in Michigan, and of other cedar firms of Michigan. Their large sorting yard in Bay City is to be enlarged and they are now taking their river drives out of the water.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

(Published first issue of each month.)

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, S. S. Stadtler, 39 S. 10th St., Philadelphia.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. C. E. Skinner, New Haven, Conn. Next meeting, New York City, Sept. 19, 20 and 21, 1905.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty Street, New York. Meetings, last Friday each month.

AMERICAN RAILWAY, MECHANICAL & ELECTRICAL ASSOCIATION. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, G. W. Tillson, Brooklyn, N. Y. Next meeting, Montreal, Can., Sept. 5, 6 and 7, 1905.

AMERICAN STREET RAILWAY ASSOCIATION. Secretary, T. C. Pennington, 2020 State Street, Chicago. Next convention, Philadelphia, last week in September, 1905.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, W. S. Barstow, New York City and Portland, Ore.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Denver, Col., May, 1906.

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CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

ELECTRICAL ASSOCIATION OF NORTH DAKOTA. Secretary, S. J. Fuller, Larimore, N. D.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, F. Fish, Rochester, N. Y.

ELECTRICAL TRADES SOCIETY (Member National Electrical Trades Association.) Secretary, Franz Neilson, 81 Wall Street, New York. Board of Directors meets second Friday of each month.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, D. Davis, Litchfield, Ill.

INDEPENDENT TELEPHONE ASSOCIATION OF THE UNITED STATES OF AMERICA. Secretary, Frank G. Jones, 48 West Jackson Boulevard, Chicago.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Annual meeting, second Thursday in January, 1906. Monthly meetings, second Thursday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting Erie, Pa., Aug. 29, 30 and 31, 1905.

INTERSTATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. M. Coleman, Louisville, Ky.

IOWA STREET AND INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

IOWA ELECTRICAL ASSOCIATION. Secretary, P. E. Bellamy, Knoxville, Ill. Next meeting, Des Moines.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

IOWA TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, J. E. Davidson, Port Huron, Mich.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind. Next meeting, Baltimore, Md., October, 1905.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 44 Whitesboro Street, Utica, N. Y. Next meeting, Boston, July 19, 1905.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, Dudley Farrand, Newark, N. J.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 114 Liberty Street, New York.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, T. R. Mercein, 85 Michigan Street, Milwaukee, Wis.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. S. Lane, 536 Ellicott Square, Buffalo, N. Y. Next meeting, Albany, N. Y., June 16, 1905.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. E. Knox, Portsmouth, O.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Chas. Currie, Akron, Ohio.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next meeting, Hotel Victory, Put-in-Bay Island, Aug. 16, 17, and 18, 1905.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, C. J. Miller, 620 Shorb Street, Canton, Ohio.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, G. P. Low, 600 Rialto Building, San Francisco, Cal.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings second Saturday of each month.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, C. W. Hobson.

SOUTH DAKOTA TELEPHONE ASSOCIATION. Secretary, H. B. Hartwell, Irene, S. D. Next annual convention, Sioux Falls, S. D., second Wednesday in January, 1906.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, W. B. Brockway, 40 Morris Street, Yonkers, N. Y.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, W. W. Cole, Elmira, N. Y.

VERMONT ELECTRICAL ASSOCIATION, Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

VIRGINIA STREET RAILWAY & ELECTRIC ASSOCIATION. President, R. D. Apperson, 723 Main St., Lynchburg, Va.

WESTERN SOCIETY OF ENGINEERS, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

Weekly Record of Electrical Patents

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N. Y.]

792,594.—COMBINED CABLE AND WIRE SUPPORTING CLIP. William J. Hiss, Jr., New York, N. Y. App. filed Jan. 27, 1905. Comprises a sheet metal clip having a curved hook to engage a usual form of lead sheathed telephone cable, and an eye for supporting insulated wires, all against a wall or fence.

792,597. ELECTROLYTIC CELL; John F. Kelly, Pittsfield, Mass. App. filed Sept. 9, 1904. (See page 23.)

792,601. SANITARY ATTACHMENT FOR SPEAKING TUBES OR TELEPHONE MOUTHPIECES; Walter S. Little, Lynn, Mass. App. filed Mar. 3, 1905. Comprises a thin diaphragm supported in a light metal casing so as to form an attachment which can be ordinarily carried in the pocket and applied to any telephone transmitter.

792,607. MEANS FOR ATTACHING POLE PIECES; James F. McIroy, Albany, N. Y. App. filed Mar. 30, 1905. Designed for the attachment of laminated pole pieces to the usual annular yokes of cast iron. Comprises T-shaped hooks with screw-threaded ends for the engagement of a clamping nut.

792,611. BATTERY-GRID; Henry C. Porter, Waukegan, Ill. App. filed Aug. 19, 1904.

792,612. BATTERY-PLATE SEPARATOR; Henry C. Porter, Waukegan, Ill. App. filed Aug. 19, 1904.

792,613. BATTERY-GRID; Henry C. Porter, Waukegan, Ill. App. filed Aug. 19, 1904.

792,634. TROLLEY HEAD FOR ELECTRIC TRAM CARS; Samuel R. Thompson, Liverpool, England. App. filed Jan. 17, 1905. A lubricating cup contains a heavy grease and a spring-pressed piston is effective to slowly force the grease against the periphery of the trolley wheel.

792,637. ELECTROMEDICAL APPLIANCE; Paul Wenigman, Chicago, Ill. App. filed Nov. 2, 1904. A body belt is provided with a pair of batteries, of which the attaching clips form the terminals, and constitute electrodes to apply the electricity to the body.

792,638. ARTIFICIAL RESISTANCE; Willis R. Whitney, Boston, Mass. App. filed Nov. 16, 1901. (See Current News and Notes.)

732,639. VAPOR ELECTRIC APPARATUS; Willis R. Whitney, Boston, Mass. App. filed Dec. 19, 1903. (See Current News and Notes.)

792,658. MOTOR STARTER; Albert J. Horton, White Plains, N. Y. App. filed Nov. 2, 1904. A mortor starter in which field resistance cannot be cut out until all the resistance has been taken out of the armature circuit. Comprises two arms which are moved together in one direction, but one of which is retained at a certain position of its movement by an electro-magnet until proper conditions arrive for the resistance to be cut out of the field circuit.

792,672. STATION INDICATOR; James H. Shepherd, Denver, Col. App. filed Aug. 22, 1903. A trolley car is provided with a tablet having the names of the stations thereon, and glow lamps in circuits closed by a sliding contact manipulated by the conductor indicate the stations successively.

792,684. ELECTRIC MOTOR; Thomas S. Watson, Milwaukee, Wis. App. filed Mar. 21, 1905. A device to relieve an electric motor of its load at starting. A magnetic clutch is energized when the motor arrives at full speed by circuit controlled from the regulator arm.

792,689. CIRCUIT CLOSER FOR TROLLEY SIGNALS. Harold E. Bradley, Warwick, R. I. App. filed Oct. 19, 1904. A trolley actuated switch in which a tappet thrown by the trolley wheel sets a dash-pot controlled apparatus in operation which closes a circuit for an interval of time great enough to insure the operation of any auxiliary mechanism.

792,691. TELEPHONY; Edward A. Buell, DeKalb, Ill. App. filed May 9, 1904.

792,692. ELECTROMAGNETIC MECHANISM; Edward A. Buell, DeKalb, Ill. App. filed Aug. 9, 1904.

792,693. TELEPHONY; Edward A. Buell, DeKalb, Ill. App. filed Oct. 25, 1904.

792,734. AUTOMATIC ELECTRIC SWITCH; Herman A. Schultz, Berkeley, Cal. App. filed Jan. 3, 1905. Apparatus for pumping out cellars, wells, etc., in which a float rising above a certain point snaps a switch which starts the motor pump which continues in operation until the float has fallen below another predetermined point.

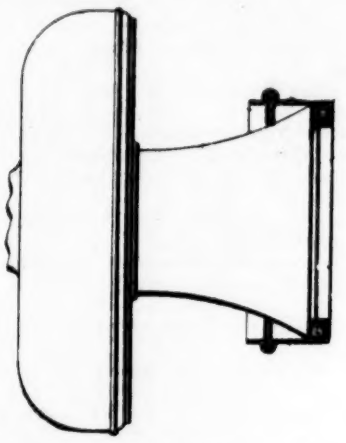
792,738. ELECTRIC CIGAR OR LAMP LIGHTER; Frank W. Smith and William H. Smith, New York, N. Y. App. filed Jan. 9, 1905. A jug-shaped receptacle contains an electrical ignition system, and an inflammable fluid,

and the stopper of the jug has a wick which is ignited by the electric ignition devices when withdrawn from the jug.

792,739. COMMUTATOR BRUSH; Charles W. Speirs, Battersea, England. App. filed Nov. 7, 1904. A plumbago brush in which the plumbago is ground up with gelatine and subjected to an enormous pressure in a lateral direction so as to expel the air longitudinally and arrange the grain in the direction of the brush.

792,741. ELECTRIC RAILWAY SWITCH; Thomas B. Stewart, William H. Turner and Rowland E. Dixon, Leeds, England. App. filed Nov. 26, 1904. A track switch has an insulated trolley section through which current may or may not be taken by the car to operate the switch in the usual way. A supplemental tappet is provided on a branch line to restore the switch point to its normal position.

792,751. ELECTROSTATIC APPARATUS; Lucien I. Blake, Lawrence, Kan. App. filed June 9, 1904. A gas-producing system supplies a continuous current of an insulating gas to the interior of a static machine. Dry



792,601.—Sanitary Attachment for Speaking Tubes or Telephone Mouthpieces.

air is employed in the structure set forth, but patentee states that other gases may be used.

792,762. DYNAMO ELECTRIC MACHINE; Gano S. Dunn, East Orange, N. J. App. filed Oct. 24, 1904. Relates to details of the casing of a generator by which the commutator is wholly enclosed and protected, at the same time permitting a rotary adjustment of the brushes.

792,776. MAGNETIC SEPARATOR; Elwin C. Kavanaugh, Holyoke, Mass. App. filed Apr. 15, 1904. The revolving drum which contains the electro-magnets for attracting the ore particles to the surface of the drum is normally filled with oil by a special pipe connection in order to absolutely exclude water therefrom.

792,783. MANUFACTURE OF PRUSSIC ACID; Wilhelm Muthmann, Munich, Germany. App. filed Oct. 17, 1903. (See page 23.)

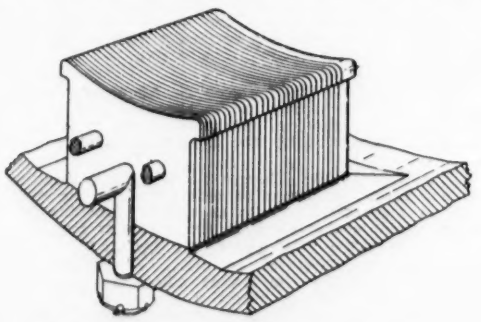
792,787. ELECTRIC UNLOADER FOR AIR COMPRESSORS; William Prellwitz, Easton, Pa. App. filed Nov. 20, 1903. A device to relieve the motor of its starting load. For this purpose an auxiliary valve is used, which is controlled by an electro-magnet, which is energized as soon as the starting arm arrives at a predetermined position.

792,792. ELECTRIC LAUNDRY IRON; Earl H. Richardson, Ontario, Cal. App. filed Jan. 25, 1904. Relates mainly to the feature of construction by which a plate of asbestos is clamped between the handle section of the iron and the face thereof in order to insulate the heat of the iron from the handle.

792,843. GALVANOMETER; Edwin F. Northrup, Philadelphia, Pa. App. filed Apr. 1, 1905. A D'Arsonval galvamometer which is mounted on a supporting vertical board which can be attached to a solid wall by a couple of screw-eyes. The telescope is on a protecting rod which can be detachably secured to said supporting board.

792,845. ELECTRICAL SWITCH; Hubert Pfirmann, Frankfort-on-the-Main, Germany. App. filed Aug. 20, 1902. Has a rocking switch and rotary mechanism for driving the same. A locking device is provided to temporarily detain the switch, which can be released at certain times by the drving mechanism, whereupon it is quickly thrown by a spring.

792,855. ELECTRIC SYSTEM; Axel L. Sjoberg, Union Hill, N. J. App. filed Sept. 23, 1904. A rotary switch is provided at a distributing point



792,607.—Means for Attaching Pole Pieces.

to direct the current into different sub-stations. The rotary switch is stepped around to different positions by a ratchet wheel controlled through a magnet and an operating circuit.

792,860.—ELECTROMAGGNET SWITCH; August Sundh and David L. Lindquist, Yonkers, N. Y. App. filed Oct. 27, 1904. Is adapted to be operated by alternating currents, and comprises a magnet having a pole piece formed to enter a socket in its armature. The armature has a switch-closing contact which also forms a spring abutment and insures against chattering.

792,860.—ELECTROMAGNET SWITCH; August Sundh and David L. Lindquist, Yonkers, N. Y. App. filed Oct. 27, 1964. Relates to modifications of the above, in which the alternating current magnet is formed with curved pole faces so as to act upon a concentric rotary armature or core to close the switch. Chattering is avoided since there is no fixed abutment for any of the parts.

792,875. BLOCK SIGNALING MECHANISM; Charles P. Bass, Portland, Ore. App. filed Mar. 7, 1904. At the entrance to each block section a switch arm is placed which may be operated by any passing car. The successive cars step around a ratchet wheel and display an additional semaphore signal until a maximum number of cars are within the block. When the cars leave the block the ratchet wheel is successively stepped backward until all the semaphores again come to safety position.

792,892. SYSTEM AND MEANS FOR LAYING ELECTRICAL WIRES IN CONDUITS. Guy M. Gest, Cincinnati, O. App. filed Feb. 14, 1903. A support for naked wires within the usual tile telephone conduits. The wires are threaded through insulating blocks which are spaced along at regular intervals. The plates are designed to have no angular turning movement, and also to shed the moisture which condenses upon their surfaces.

792,900. RAILWAY SIGNALING; Ernest C. Irving, Westminster, England. App. filed Mar. 14, 1903. A semi-automatic railroad system in which special devices are thrown into action when a switchman, on account of light traffic conditions, sets everything to safety and leaves the cabin. Under these circumstances a pneumatic control system is thrown into action which operates automatically.

792,903. TROLLEY STAND; Frank N. Kelsey, New Haven, Conn. App. filed Apr. 14, 1905. The trolley pole is held against the wire by a flexible spring-pressed connection at a point on its length. Supplemental springs are provided to compensate for the change in tension due to angular variations in the position of the pole.

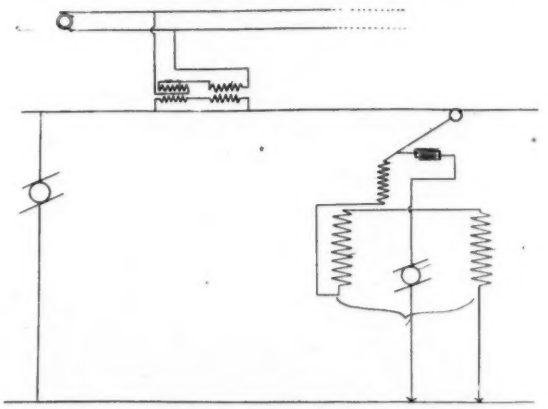
792,922. APPARATUS FOR CONTROLLING TRAFFIC ON RAILWAYS; Thomas H. Patenall, Wilkinsburg, Pa. App. filed Oct. 27, 1904. Relates to an improvement in "staff systems" and has means whereby the insertion of the staff within the controller synchronizes all of the instruments and permits another staff being withdrawn from either instrument or from the controller itself. When a staff has been removed from any of such instruments another staff cannot be removed from any of the other instruments.

792,927. TELEPHONE-TRANSMITTER; De Elbert A. Reynolds, New York, N. Y. App. filed Feb. 25, 1905.

792,959. CLAMP FOR TROLLEY WIRES; Cris C. Bakewell, Kaylor, Pa. App. filed Mar. 31, 1905. A hanger has a fixed and a pivoted jaw which can be forced together to clamp the trolley wire by means of a screw in the fixed jaw.

792,963. RAILROAD SIGNAL; Albert M. Bullard, Somerville, Mass. App. filed May 8, 1903. Has means by which danger signals of different sorts are produced by direct currents, or by an open circuit, but safety signals can only be received within the locomotive cab by an alternating current which causes lamps to flash periodically and thus indicate the safety signal.

792,985. SAFETY DEVICE FOR TROLLEY POLES OF ELECTRIC CARS; Daniel R. W. Hardman, Liverpool, England. App. filed Mar. 14, 1905. A retrieving device for trolley poles in which the trolley current normally



793,033.—Electric Circuit.

energizes a magnet which controls a detent for the rewinding spring. Should the trolley leave the wire the magnet is de-energized and the spring drum rendered effective to wind up the trolley cord and lower the pole.

793,004. EYE-MASSAGE MACHINE; Frank H. May, Birmingham, Ala. App. filed Apr. 8, 1905. Contains a diaphragm adapted to fit against the eye and a magnetic vibrator for imparting a movement to said diaphragm. Electrodes are provided for passing a current through the eye at the same time.

793,033. ELECTRIC CIRCUIT; Isidor Kitsee, Philadelphia, Pa. App. filed filed Oct. 16, 1903. An alternating current is impressed upon a circuit in which a direct current is normally flowing, and the receiving apparatus at the other end contains two branches, one having inductive resistance and the other capacity, so that only certain instruments respond to certain characteristics of the current flowing.

793,035. ELECTRIC METER; Isidor Kitsee, Philadelphia, Pa. App. filed Nov. 17, 1902. An electric motor is operated by a high resistance shunt circuit across the mains. The speed of the motor is controlled by a mercury brake which is applied more or less in proportion to the current flowing. The motor is connected to the usual registering means.

793,036. ELECTRIC CLOCK; Isidor Kitsee, Philadelphia, Pa. App. filed Nov. 17, 1902. A self-winding clock in which a weighted arm acts directly upon the escapement wheel. When the arm falls to a certain position, a magnet is automatically energized which raises the arm.

793,037. ELECTRIC TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed Feb. 4, 1905. A code adapted for submarine telegraphy in which a dash comprises two impulses of opposite polarity and a dot, a single impulse.

793,039. PROCESS OF TREATING THE METAL MIXTURES PRODUCED AS A BY-PRODUCT IN ELECTROLYTIC METAL-REFINING; Anson Gardner Betts, Troy, N. Y. App. filed May 20, 1904. (See page 24.)

12,364. AUTOMATIC NON-INTERFERING REPEATER FOR FIRE-ALARM CIRCUITS; William H. Kirnan, Bayonne, N. J. App. filed May 4, 1904. Means are provided whereby two signals are received at the same time on one or more of the street magnets, whereupon all of such street magnets will operate in unison. As soon as any one receives a signal in advance of the others it will be "disabled" and the last one receiving the signal will continue to operate until its entire signal has been received.